THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE.

DEVOTED TO THE MECHANIC ARTS, INTERNAL IMPROVEMENTS AND GENERAL SCIENCE.

MARCH, 1826.

FOR THE FRANKLIN JOURNAL.

On the Rise and Progress of the Franklin Institute.

CONCLUDED.

Upon some of the points brought before the attention of the meeting, the discussion was long, and ably carried on. Much interest in the subject was evinced, and however warmly each advocated his opinions, yet the unanimity with which all concurred in the decisions of the majority, showed evidently, that the wishes of all were directed to the achievement of the same great object; and that the anxiety of each was, not so much for the triumph of his own opinions, as for the adoption of those measures which would best ensure the success, and duration of the Institution.

This meeting has been considered as fixing the period of the organization of the society. Previous to that day, the committee had, with a view of enlisting additional support to their plan, opened a book, in which many of their friends had been induced to inscribe their names; at the beginning of the meeting, it did not include more than one hundred signatures, but a considerable number was soon added to the list.

The first election for officers, was held at the time appointed; and terminated in the choice of a Board, composed principally, of men practically engaged in the mechanic and manufacturing arts; and who have hitherto shown themselves fully aware of the important interests confided to them. We have observed, that in several of the European Institutions, the choice of managers is in part, or wholly restricted to the class of journeymen mechanics; an idea having been unfortu-

nately held out, that their interests, were distinct from those of the master mechanics; and that the latter could not be entrusted in the management of an institution, one of the principal objects of which, is to educate their own sons and apprentices. Fortunately no such principle of exclusion pervades our association; and we deem the absence of it, to be by no means unconnected with the prosperity which has hitherto attended it. We trust that all mechanics' institutions will succeed, in spite of any obstacle which may be thrown in their way; but we cannot close our eyes to the fact, that all have not achieved objects, commensurate with the hopes of their founders. We know of one, established in a city much larger than Philadelphia, the success of which has not exceeded, scarcely equalled ours, though it has met with large donations from many of its public-spirited members. In the instance to which we allude, we have reason to believe, that the failure was produced by that provision of the constitution, which required the introduction of a large proportion of journeymen, into the Board.

Since the foundation of the Franklin Institute, no event has occurred to interrupt its successful progress. Its usefulness, in more respects than one, has been felt and acknowledged. Comprehensive in its views, it includes within its design, every measure that can promote the success of those, to whose interests it is pledged. Unrestricted, as to the qualifications of its members, it enlists with pleasure, among its supporters, all persons disposed to countenance, and foster our manufactures. It touches not those points upon which differences of opinion, have been, and are still entertained, by our public-spirited, and enlightened statesmen. The Franklin Institute interferes not in the great question of protecting duties; it has no political object in view; the framers of its constitution, were deeply sensible that its great object, the promotion of the mechanic arts, would be best secured by restricting the views of the society, to the dissemination of knowledge; to the enlightening the mind of the youthful apprentice, to the examination of the inventions made by the mechanics of our country, so as to test their novelty, or the soundness of the principles upon which they were constructed, and finally, to the proud display of our manufactures at stated periods; in order to convince the incredulous, of the progress which our artists are making, and with a view that the unprejudiced citizen, may compare our own productions, with those which he is in the habit of importing. Satisfied, that whenever he is enabled to obtain the former, of equal quality, and at the same price as the latter, his own interest will induce him to encourage his manufacturing fellow citizens, to the exclusion of foreign artists. The reports made by the Board, to the Institute, at their quarterly meetings, contain so full a history of the transactions of the Society, and have been so widely circulated, that we feel ourselves excused from dwelling long upon this subject. We shall, however, briefly state the most promtnent objects achieved by it; and some of those, which still remain to be prosecuted, as the Institution shall become more generally supported, and more wealthy.

The course of instruction in the Institution, was commenced on the 28th of April, 1824, by a lecture delivered at the Philadelphia Academy, in North Fourth street. The Institute being at that time unprovided with a building, and its funds being very low, an application for the use of the rooms in the Academy during the summer, was made to the Trustees of the University of Pennsylvania; it is unnecessary to add, that the request was very handsomely, and liberally granted. The lectures, which were on miscellaneous subjects, and were delivered gratuitously, by volunteer lecturers, were continued weekly, for several months. The size of the class, gave sufficient assurance, that the mechanics of the city, were fully aware of the importance of the rising institution. The number was found to be considerably increased, at the commencement of the winter, when lectures on Chymistry as applied to the Arts, Natural Philosophy and Architecture, were regularly delivered by Professors appointed for this purpose; and to whom small salaries, proportioned to the funds of the society, were voted. In addition to these, the system of volunteer lectures, which had given such general satisfaction during the summer, was continued once a week. The lectures were kept up until the month of April.

About the middle of November last, a third course of instruction was commenced, which included, besides the regular lectures of the preceding winter, a course of Practical Mechanics, and one of Natural History. To the latter, the members were allowed to introduce ladies; it had been believed that few would avail themselves of the privilege, and it was therefore with surprise, as well as pleasure, that the Board found the class included nearly one hundred ladies.

Aware that the Institution was intended, more especially, for the education of youthful, than of adult mechanics, the attention of the members was directed, at an early period, to the adoption of measures which would secure this object, and at the same time not interfere with the order and quiet of the class. This was at last accomplished, by issuing, to each member, any number of tickets that he might require for his sons and apprentices; he paying, for each of these tickets, the sum of one dollar. This amount, so small in itself, that it can in no manner produce inconvenience to those who pay it, is, however, sufficient to prevent any from attending, whose only object would be the gratification of an idle curiosity; while, at the same time, it insures the punctual attendance of those whose friends have incurred this expense. Of the success of this plan, no statement can give a more satisfactory idea, than the fact, that the number of junior students, who attended the first course of lectures, amounted to 27—that to the second course, 126—and that to the third course, 180.

The method of teaching by lectures, excellent as it is in subjects which require experiments and demonstrations, cannot, however, be extended to all branches of instruction. There are some which can be taught only in schools, where the instructer converses freely with his pupils; solves their doubts, removes the difficulties which they may suggest, and never proceeds to a new subject until the former is fully understood. Of this nature is the science of ma-

thematics; and, for obvious reasons, the art of drawing, can only be taught in this manner. These being deemed all important to the mechanic, schools were opened for instruction in drawing and mathematics, in the winter of 1824–5. These could not, of course, be made accessible to all, upon the same terms as the lectures; but the tickets were placed at so low a rate, that the price of them could scarcely be an objection. These schools have flourished: the number of scholars, at present in the drawing school, is about forty; in the mathematical school, about twenty.

The advantages of this method of instruction have been so fully acknowledged, that we have heard it stated, as the opinion of several members, that it might be judicious to extend it, so as to include all the branches of an elementary education; particularly reading, writing, and arithmetic. There are in the city, and among the members of the Institute, many persons whose circumstances in life, are such as not to make it necessary for them to depend on public schools for the instruction of their children; but, to whom, the prices paid at most private schools, would be inconveniently high. There are also many who could not spare the services of their children, at those hours of the day, at which the schools are generally held: for these, the establishment of evening schools, at a moderate price, and under the superintendance of an able teacher, would doubtless prove a desirable object. This plan, might perhaps be extended, with advantage, still further, so as to make it include some of the higher branches of mathematics. There may be difficulties in the way, which will retard, or even prevent the adoption of this scheme; but we believe it practicable, and hope it will be brought forward. Indeed, we almost feel confident of its success, as we know that it has long been a subject of deep consideration with some of the most active and zealous members of the Institution, whose suggestions have hitherto generally proved successful.

Next in importance, to the extension of education, is, undoubtedly, the exciting of a spirit of proper competition among the manufacturers, by means of premiums, and annual exhibitions. Accordingly, this also received the attention of the Institute from the earliest moment of its existence; and the two first exhibitions, which were held in October, 1824 and 1825, have, it is believed, given general satisfaction, and been productive of much good. Gold, silver, and bronzed medals, had been offered for the best articles presented in many branches of industry, and upwards of fifty silver, and bronzed medals, have been awarded. It is to be regretted, that the limited funds of the Society, and the great drafts made upon it for various important objects, have restricted it in the number and the value of the premiums offered and awarded. There cannot, we believe, be a more agreeable, or a more useful application of money, than the rewarding of merit and skill in the arts. It may be a question, not unworthy of the attention of the legislator, to consider what part of the progress made by the arts in England, is to be ascribed to the liberal rewards so judiciously bestowed by the public spirited Society for the encouragement of the Arts, in London. The slight annual expenditure, which would be

incurred in this manner by our state, would be amply repaid to the nation, by the additional sources of wealth which it would receive from the resulting improvement in the arts.

As accessory, but not less useful branches of the Institution, are the creation of a library, and of a collection of minerals. These are yet in their infancy, but in the course of time they must necessarily become valuable. The day will likewise come, we trust, when the Institution will be able to establish, and keep open, a laboratory expressly devoted to the gratuitous chymical examination of all minerals that may be sent to it, from any part of the state. This could be easily accomplished, and at no very great expense, in a well conducted laboratory, placed under the care of a skilful professor, whose duty and interest it would be made, to devote his whole time to it. Under proper regulations, students might be admitted, in order to become practically conversant with the principles of chymistry, especially in its relations to the arts; and series of experiments might be occasionally instituted, to test the value of projected improvements, or of new processes. A workshop, established with similar views, but placed under the control of a skilful mechanic, might offer opportunities to young men to become familiar with the use of tools. They might be taught the art of turning, and probably some of the different branches of clock-making, which offer such beautiful illustrations of the principles of mechanics.

Perhaps, one of the most interesting steps which the Institute has taken, has been the erection of the new Hall; a spacious and elegant edifice, which, if we may trust to calculations that have been carefully made, promises to become a productive property to the Institution.

Finally, the publication, under the auspices of the Institute, of a Journal devoted to the promotion of the mechanic arts, is another of the means which the Society has devised for the attainment of the objects for which it was instituted.

On reviewing what has been done by the Franklin Institute, no doubt will, we trust, be entertained, that it has accomplished much, and realized the fondest hopes of its projectors. That there still remains much to be done, cannot, however, be doubted; and it appears to us equally certain, that as the Society increases in numbers and in wealth, a wider field will open before it; and new objects, at this time little thought of, will present themselves to its attention, thereby affording to it the means of extending its usefulness, and of applying the surplus of its funds. The number of its members, is computed, at this time, at upwards of one thousand; and great as this may seem, we feel convinced that it is not one-third of what it will eventually become, if no unforeseen event occurs to mar its prospects. There is no reason that need prevent a person from joining the Society, but extreme poverty; and how few are there in our city, so restricted in their pecuniary concerns, as to be unable, annually, to devote the sum of three dollars, to the promotion of the public good; especially when this small appropriation will afford to their children the means of instruction; rendered the more acceptable, and the

more valuable, by its being paid for. On the other hand, there is not a person in the city, placed by his wealth, or by his relations in life, in circumstances that make him wholly independent of, or uninterested in, the progress of the arts—as a citizen, he is imperatively called upon to promote the public good, and as one gifted by Providence with wealth and plenty, it becomes especially incumbent upon him to contribute his mite to the extension of education, and to the encouragement of the labouring and industrious portions of the community. W.

In our last number we published the Prospectus of the Reports of Mr. Strickland, made in conformity with the Instructions of the Society for the Promotion of Internal Improvements: we now conclude these instructions, which, together with the extracts from the first annual Report of the Acting Committee formerly given, will furnish a tolerably correct idea of the value of the proposed work.

Society for the promotion of Internal Improvements.

MR. STRICKLAND'S INSTRUCTIONS.

[CONCLUDED.]

Turnpikes.—On the subject of the improved mode of constructing roads by Mr. M'Adam, we have, as you know, all that has been published. These publications, however, give us rather the evidence of the excellence of the roads made upon that plan, than a practical and familiar description of the *manner* in which they are executed. A report descriptive of the first preparation and arrangement of the ground over which the road is to pass, and which is to become the foundation of the stone-work; the following steps preparatory to the covering of this, with stone; the nature of the stone to be used; its preparation, and the manner in which it is applied; the measures adopted to prevent injury to the road while in the course of construction; the final completion of the road, and the mode of keeping it in order; with the regulations as to its use, particularly the description of carriages or wagons used upon it: all these will command, and obtain your careful attention. Should you think the suggestion worthy of your consideration and adoption, we would propose that you should prepare, or obtain a memoir on this subject, directory of the course of proceeding to construct a M'Adam's road; so particular, so full, so descriptive, so plain, and accompanied with such illustrations by drawings, as will enable any good road maker, to commence and execute the work.

A person who is perfectly acquainted with M'Adam's principles of road making, who has been accustomed to apply them in the construction of roads, and who should bring with him testimonials of character and practical skill, would find employment in the United States. The Society will not give a pledge to compensate such an individual for visiting the United States, but you are authorized to assure him, that all that the patronage and efforts of the individual members of the association can do, to promote the fortunes of such a man, will be exerted.

Gas Lights. The proposed introduction of gas into the city of Philadelphia, makes it important, that at as early a moment as your other duties will permit, you furnish a full report upon this subject. What is the best and most economical apparatus? What material is preferred, and the reasons for the preference, the cost of the material in England, the most approved plan for conducting gas from the place of manufacture to where it is used, the employment of detached and transportable gasometers or fountains, and their cost, and their mode of use, and how all the machinery which may be required for the construction of the works, and for the distribution of gas in Philadelphia, can be obtained, and at what costs? These are submitted as heads of inquiry.

Break Waters. The intimate connexion between the commercial prosperity of our state, and its internal improvement; and the important advantages which would be consequent on the erection of a breakwater, at the mouth of the bay of Delaware, have induced the Society to ask you to procure information of the most approved plan for constructing a floating breakwater. A floating breakwater is said to have withstood the destructive storm which lately shook, to its foundations, that which was built of stone at Plymouth; and as the cost of the former is said to be much less than that of the latter, it is desired to obtain a full knowledge of the plan, and construction of the same; how anchored and sunk, its capacity to resist the ocean, and the effect of the same upon it; its cost and its competency, compared with works of a similar kind, which are built of stone, and are intended to be immoveable?

Manufacture of Iron. We approach this subject with the deepest impression of its importance, and with a firm conviction that the full investigation of it, will require more time than you can bestow upon it. We are satisfied that it would yield golden returns, if an agent of competent talents and information, should be exclusively employed in the investigations and inquiries, connected with the manufacture of iron, in England and Wales. If the wealth of England has been correctly ascribed to her iron, and her coal, Pennsylvania may with equal certainty, become the England of the New World, in these riches; for she has coal of a quality superior to that of her most prosperous rival, and she has great varieties of this most valuable mineral; and she has iron ores of every description and kind which are known in any part of the world. No improvements have been made here in it, within the last thirty years; and the use of bituminous and anthracite coal, in our furnaces, is absolutely, and entirely unknown. It is said, that since the use of mineral coal in the making of iron, was introduced, England has increased the manufacture of this article, many thousand fold; and the cost of its production, has been diminished one-half.

Attempts, and of the most costly kind, have been made to use the coal of the western part of our state, in the production of iron. Furnaces have been constructed according to the plan *said* to be adopted in Wales, and elsewhere; persons claiming experience in the business,

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have been employed, but all has been unsuccessful. In large sections of our state, ore of the finest quality, coal in the utmost abundance, lime-stone of the best kind, lie in immediate contiguity; and water power is within the shortest distance of these mines of future wealth. The prices which are obtained for iron on the western waters, are double those of England; the demand is always greater than the supply, and thus, nothing but knowledge of the art of using these rich possessions, is wanted.

But it is not only in the knowledge of the production of iron, that we are behind the country you are about to visit. In the art of casting, in making bar-iron, the improved state of knowledge you will find in England, has given her a superiority, which would enable her to command our own market, but for the protection the manufactures have in the tariff.

We desire your attention to the following inquiries on the subject of the manufacture of iron.

1st. What is the most approved and frequent process for coking coal, and what is the expense of the process per ton, or chaldron?

2d. In what manner are the arrangements or buildings, if any, constructed for the coking of coal? obtaining drawings, and profiles thereof.

3d. Are there different modes of coking coal? and if they have any differences in principle, what are they?

4th. In what manner are the most approved furnaces for the smelting of ore, constructed? Drawings and sections of the same to accompany the information which may be obtained upon this inquiry.

5th. The mode of drawing off the pigs, and the plan adopted for keeping a supply of ores; if peculiar, or superior to that used in this country.

6th. The making of castings. Is there any process by which castings are made *soft*, so that they may be substituted for brass or copper? if there is, what is that process?

7th. What is the most approved construction of a foundry, and what the most approved mode of casting? Drawings, profiles, and minute descriptions to accompany the information you may collect, upon these inquiries.

8th. What is the most approved mode of making bar iron, and what is the most approved machinery used in the same? drawings, profiles, and a description of the same are requested.

9th. Is the *Anthracite coal*, used in any processes for making or using iron? If it is, all the information of the mode of its use will be of the greatest importance.

10th. The best mode of making steel. Where is it made, from what quality of iron? How the English blister is prepared, the process for its production; does it require a peculiar kind of iron, or does the quality of the best steel, depend exclusively, on the mode of carbonating the iron?

11th. At what stage of the process of converting bar iron, into

steel, does the agency of the coke commence? Is charcoal used in any of the processes for making steel? When, how, and to what extent is it used, if at all?

12th. What is the construction of a furnace for making steel, upon the best, and most approved principles? What time is required, to convert a given quantity of iron, into steel? The degree of heat, the material from which the iron absorbs the carbon, how prepared?

13th. What proportion of the English bar iron, is made at present by *rolling*, and what by *hammering?* What is the opinion of enlightened practical men, as to the comparative merits of each?

14th. Has the English iron been so far improved, as to admit of its being used in the manufacture of cast steel in competition with the Swedish? If so, from what ore is it obtained, and by what process? Is the coke of bituminous coal, used in this process?

We submit for your prudent consideration, some suggestions on the subject of these inquiries, assuming the fact that they cannot be prosecuted by you, to the full extent. We are willing, on the part of the Society, to authorize you to expend, in obtaining all the information which they seek for, the sum of one hundred pounds sterling. This sum might induce some individual to prosecute in detail, the investigations, and collect the information so much desired. This will not be an unprofitable expenditure by the Society. But one gentleman, interested in the manufacture of iron, is a member of the Society, and we shall take care to reimburse the Society from among those who manufacture this great staple of the state, before we communicate what you shall transmit to us.

You are aware of the importance which is here attached to the use of *anthracite* coal, in the smelting of iron. To the eastern portion of our state, full and accurate knowledge of this art, if it exists in Ireland or England, would be productive of the richest results. Should you find that anthracite coal is in use in making iron from the ore, and any one, with perfect skill in the art, and of good character, will come to this country for the purpose of obtaining employment in the making of iron with the anthracite coal; you may agree that his passage to Philadelphia shall be paid by the Society, and you may give him every assurance of further patronage.

Rollers of Cast Iron.—How are they cast and hardened?

Rollers of Brass or Copper for Calico Printing.—There is a patent for making these. Endeavour to get at it, and acquire all the information which will enable one skilled in the art, to cast them here. This is to be the subject of a special report, accompanied with a model, if you can procure one.

Machinery.—Useful machines of all kinds will command your attention. Those which can be employed in connexion with canals, and roads, will be of the highest importance. The letter of Professor Keating, suggests inquiries on the subject of steam boats, used for canals. These may become very important here, and steam boats with small draughts of water, will be required for some of our rivers, if they shall be made navigable by dams.

The letter of Thomas Butler, Esq. suggests for inquiry, the mode

for diffusing heat in vessels. That of Mr. Sellers, to the best machine for preparing, and dressing flax. We beg your attention to these subjects. As you have the aid of Mr. Kneass, your pupil, we have less hesitation in claiming from you frequent communications, of your progress, and success. These, if favourable to the purposes of your agency, will give confidence to the members of the Society; and they will also justify our claims on the citizens of Pennsylvania, to aid us, by pecuniary contributions. You may rely on the exercise of a careful, and guarded discretion, in making public, by means of the press, the contents of your correspondence. To the members of the Society, your commmunications will always be open; but their publication in any other form, will be the result of proper deliberation.

During your absence, we shall have frequent occasions to communicate with you. We shall forward all our letters to Messrs. Curwen and Hagerty of Liverpool, and we would suggest that you, at all times, place with them your address, and through them, by our Philadelphia packets, communicate with us, directed to the Corresponding Secretary.

By the resolution of the Society, passed on the 3d of February last, you were appointed the Agent of the Society, to proceed to Europe, for the purpose of prosecuting the inquiries, stated in your instructions. Your compensation for an absence of twelve months, on the duties assigned to you, is to be $2500, of which £400 sterling shall be placed to your credit in England, at par, and the residue of this sum, to be paid to you, or your order here.

In your instructions, you are authorized to expend one hundred pounds sterling, for obtaining correct information relative to smelting iron ore, and the improved manufactory of iron.

The Society, by a resolution adopted at the meeting held on the 17th March, instant, have authorized you to expend one hundred pounds sterling, for memoirs, publications, models, drawings of useful machines, and authentic information on all subjects which are important in this country.

You will take due notice of these appropriations, and we beg leave to recommend a judicious economy in the expenditure of this money, and that you keep an accurate account of the same, which you will render to the Treasurer of the Society.

The arrangements in relation to the funds to be placed at your disposal in England, and the payments to be made here, are left with the Treasurer, Mr. White, who will attend to the same.

We desire an acknowledgment of the receipt of these instructions, and your assent to the same. With every wish for your success in the performance of the important duties assigned to you, and of a happy and safe return to your family and friends, we are, with great esteem and respect,

Your obedient servants,

MATHEW CAREY,
RICHARD PETERS, Jun.
JOSEPH HEMPHILL,
STEPHEN DUNCAN,
} *Members of the Acting Committee.*

Attest, GERARD RALSTON, *Corresponding Secretary.*

New Metal, in imitation of Gold; called Mosaic Gold.

A new discovery has recently been made by Messrs. PARKER and HAMILTON, in mixing a certain alloy of metals, which exactly resembles fine gold. The base of the metal is supposed to be copper, and a constituent part of the alloy, zinc; but the composition, and its proportions, are for the present, kept secret. Messrs. P. & H. have obtained a patent for their discovery, but the specification will not be enrolled until next May. The colour of the metal is extremely beautiful, and uniform throughout the mass; its specific gravity is considerably less than gold, but something more than copper; the cost price of it about the same as brass, and it is susceptible of being cast, chased, carved, and burnished.

The specimens we have seen, were wrought into fruit, foliage, and scroll work, which exactly resembled fine gold, with a matted, and burnished surface. It is said that this metal will not be subject to oxydation in the open air, and that it has resisted some of the acids; may be easily re-polished, but will not retain its character if re-melted, without being treated in a peculiar manner. These are all the particulars we have yet been able to collect, but as the subject is likely to become of considerable importance, and to engross much of the public attention, we subjoin the account given by the patentees themselves.

"In introducing the above invention to public notice, and in developing those views of it, which almost naturally arise, it is but due to the patentees to state, that the discovery of "The Mosaic Gold" was not the result of accident, nor a fortuitous combination; but is the reward of a series of costly, and laborious experiments, carried on at intervals, for upwards of twenty years, and more particularly for the last three years; during which period, the most active and unremitting perseverance has been used, to obtain the metal in the state of perfection which the specimens exhibit.

"The richness of colour, and close resemblance to gold possessed by this new metal, induced an individual, well qualified to appreciate its merits, to submit it to his Majesty, who, ever ready to promote the interests of science and the arts, has graciously condescended to permit the patentees, to announce to the world that he patronises the invention. This gratifying encouragement, together with the boundless field of trade, opened by the applicability of the Mosaic Gold to all purposes of the useful and decorative arts, at once convinced the patentees, that their individual power would be utterly inadequate to establish and support the extensive manufactories, necessary to carry into execution the various lucrative objects that presented themselves. These considerations, and the great importance of the trade, (even in a national point of view,) which must result from the manufacture of an article possessing the qualities of the Mosaic Gold, have determined the patentees to grant licenses for working it; as the best means of extending the interests, and diffusing the great benefits arising from the introduction of an article, which, as must be obvious to every one, admits, and will reasonably bear, considerably more than the ordinary

profits of trade. This position will be best supported by the following statement of the *qualities*, *uses*, and *advantages* of the Mosaic Gold:

"1. The Mosaic Gold possesses throughout its whole mass, a rich golden colour, far superior to the colour of pure gold, and fully equal to that of its most beautiful alloys.

"2. It is capable of being cast, and worked into any form, with the same facility as other metals.

"3. While the Mosaic Gold is so beautiful, when highly wrought and applied to articles of superior value, as to challenge a rivalry, in its appearance with gold itself, it can also be produced in other states, which, as respects price, will admit of its being used for architectural and other embellishments.

"4. Being of a uniform colour throughout its whole substance, it is peculiarly applicable to articles subject to wear, and friction.

"5. The Mosaic Gold, when applied to interior decorations, and furniture, does not produce the unpleasant odour of bronze, or brass.

"6. In case of accident, its original colour, and lustre, can be easily recovered, by the ordinary modes of cleaning gold, or silver.

"7. In addition to the above properties, the Mosaic Gold adds the invaluable one of not easily tarnishing or oxidizing, so that it may by simple means, always be preserved in its original freshness, and lustre.

"On this point a most decisive experiment has been made, by exposing several subjects, cast in Mosaic Gold, on the damp grass, for eight weeks, to the sea air, without any perceptible change or deterioration being produced in the colour; a fact which can be fully authenticated, and the particulars of which, may be had of the patentees.

"The Mosaic Gold is peculiarly applicable to the following articles, each of which forms an extensive branch of trade.

"Articles of plate and jewellery—salvers—plateaus—branches—wine coolers, &c.—candelabra—chandeliers—lamps—chimney-pieces—clocks—balusters for staircases—railings—architectural decorations—freizes and capitals of columns—statues and groups—bas-reliefs—vases—medals—enrichments for domestic furniture of various kinds—carriage and harness furniture, &c. &c.

"A valuable feature in this discovery, and most important as respects the Fine Arts, is, that from the metal being in itself, comparatively with gold, of small intrinsic value, liberal encouragement may be afforded for the talents of our first artists, to make designs and models, from which articles in Mosaic Gold, of unparalleled beauty, may be manufactured; for all persons of taste, who have visited the continent, and inspected the extensive manufactories of works of art, in bronze, must lament how much we are excelled in this, perhaps the highest branch of manufacture; and it is therefore with pleasure the inventors can assure the public that extensive works, commenced under the most favourable auspices, are now erecting in the Regent's Park, which will afford every opportunity of attaining these desirable advantages.

"In order to place this invention on the most liberal plan, the Mosaic Gold will be sold to the trade in ingots, and licenses may be obtained for working it."—[*London Journal of Arts and Sciences.*

ON BREWING.

Sir—Being a constant reader of your valuable Magazine, I observed, as far back as May 14th, and at subsequent periods, inquiries have been made concerning Brewing, the comparative strength of malt and sugar, &c. I expected to have had some valuable information on the subject, long before this time, but little elucidation has yet been given: will you allow me to state a few practical remarks that I have made?

The first grand step towards bringing to perfection, brewing, wine-making, fermenting, and distilling, (as they are children of the same family), is to have a universal hydrometer, or floating ball, to take the strength and value of worts, extracts, and spirits. It should be divested of all arbitrary, and local phrases; described in one plain, simple, and universal language; we could then communicate the results of our practice to each other, and be understood. I know of none so simple and effective as specific gravity—it is the groundwork or father of all others, and a language known in all parts of the kingdom.

Impressed with this idea, about fifteen years ago, I made my first attempt at scientific brewing, by superintending that process for my own family. Our brewing is small, consisting of about six bushels, six or seven times in the year, without regard to season or weather. I use a thermometer to try the heats of water in mashing, and worts in fermenting. I have also got made in the country, a very simple hydrometer, consisting of a floating ball, and a few weights, with which I take the specific gravity of my worts and extract, and the strength of spirits; as I sometimes experiment on distilling, in a small way, and occasionally, manufacture a little family wine. I have formed tables of specific gravity, corresponding with pounds and ounces of density and dry extract, as used by Dring and Fage, Dicas, and others; with the quantity of spirits created by different degrees of attenuation; I have kept a journal of proceedings, and the results: and if a description of the instrument, or the construction of the tables, or any other part of the process I have used, would in any way tend to simplify or render more easy the practice of brewing, which at present is very imperfectly, and irregularly performed, I would most willingly, send any thing I am in possession of, to you for insertion.

As your Leominster Correspondent has expressed a wish for a practical report, I have here sent a rough outline, with the probable results, which will vary with the circumstances. As addition is the easiest rule in arithmetic, I have stated the process, in the proportion of one single bushel of malt, and the produce calculated to one gallon, in lieu of a barrel, as it is usually given.

To mash.—Put ten gallons of boiling water into a tub, furnished with the usual appendages for drawing off the wort; when the water is cooled down to 180°, put to it one bushel of good malt; the coarser it is ground the better, so that every corn is broken (cylinders that bruise the grain are better than mills that grind it into flour); stir up the water, and malt, well together, let it stand three

hours, then draw it off, and you will have six gallons, four having been absorbed by the malt.

Second mash.—Put on five gallons of water, at 183°, stir it up well, and let it stand on, two hours; let it then run, and you will have five gallons off.

Third mash.—With about three gallons of water, at 186°; stir it up as before; let it stand on, about an hour, and you will draw off about the same quantity as you put water on.

Fourth mash, for Small.—Six gallons of water at 190°; let it stand on, during the time the ale is boiling.

Boil the Ale.—Put the three first mashings, which are about fourteen gallons, on the furnace, with one pound of good hops; let it boil as fast as possible one hour, then strain it off, and you will have little more than ten gallons.

Boil the Small.—Put the fourth mashing, of six gallons, into the furnace, and return the hops strained from the ale; let it boil as fast as possible, one hour and a half, or until it is reduced to about four gallons.

Produce.—The first strain-off of the ale will be ten gallons; at the heat of 75°, will be of the specific gravity of 1.077. The increase of weight, or density as it is called, will be about 7lb. 14 oz. heavier than the water weighed before it was put over the malt, and will contain 20lb. of dry extract, equal to 2lb. per gallon. The small beer, will have the specific gravity of 1.020—about 8 oz. of dry extract per gallon, or 2lb. the whole. Thus you have extracted and obtained 22lb. of soluble matter from one bushel of malt. From 19lb. to 23lb. per bushel, is the usual quantity, and I much doubt if more than 16lb. or 18lb. is, on the average, got from a bushel of malt, where the process is conducted by the rule of thumb.

Fermentation.—The grand, and most important process, remains yet to be performed. I wish I could do justice to the description of it. As soon as you have strained off the ale, put it into shallow vessels, and get the first violent heat out of it, as soon as possible. Put three or four quarts into a very shallow vessel, and cool it down to 80°; put to it, about a quarter of a pint of good fresh yeast; then empty it into a deep narrow vessel, and it will ferment rapidly. In the mean time, the other is cooling, and when reduced down to 75° put them altogether in the working tub, which should be deep, and not too wide. In about nine or ten hours, it will be in a high state of fermentation, with a fine white curly head of yeast, like a cauliflower; let it continue in that state, until the bulbs that are formed in the yeast, begin to look thick, heavy, and dim; and true, or solid yeast, is beginning to be formed; that is the time to tun it, or put it into the cask, before the head has fallen, when it is in the highest and more vigorous state of fermentation. The length of time it will require to arrive at that state, is very difficult to describe; varying, according to circumstances, from 18 to 36 hours. When tunned, as it is called with us, that is, put into the cask—it must be quite full, and the bung put in the top, and it will throw out yeast, or cleanse itself, from the top cork-hole in the front of the cask, just below the head; and it must be filled

up every two or three hours, until it ceases to throw out any more yeast. Then cork up the cask, pull out the bung at top, fill it up tip full, and it will throw up more yeast, which must be skimmed off occasionally, as long as any is formed; then take a little beer out, just to sink it down, so that it does not touch the head of the cask; put the bung loosely in, and in a few days, or when it has ceased to ferment, and is reduced to the same temperature as the cellar, bung it down tight. In a month, or less after, you may tap it, and have a good and wholesome beverage, rich in flavour, pleasant, good tasted, and as fine as wine.

I remain, Sir, your old servant,

EXPERIMENTUM CRUCIS.

Stratford on Avon. [*London Mechanics' Magazine.*

On the processes of Tanning, Leather-Dressing, and Dying, &c.

(Continued from page 120.)

Lastly, when fully tanned, the hide is taken out to drain, and stretched upon a convex piece of wood, called a *horse*, on which it is thoroughly smoothed, and beaten, with a heavy steel pin; or sometimes passed between iron cylinders, to make it more solid, and at the same time, supple; after which it is taken to the *drying-house*, a covered building, with apertures for the free admission of air, where it remains till perfectly dry.

The common calves skins, require, for the whole process of conversion into leather in this way, from two to four months; the thick sole-leather hides, from fifteen to eighteen, or twenty months; and a boar's shield, can hardly be finished in less than two years. Leather gains in weight, and improves in quality, the longer it is suffered to remain in ooze, (within certain limits,) and as it is sold by weight, this is also sometimes an object to the tanner, though counterbalanced to a great degree, by the length of time that must elapse before his capital is returned.

The art is indebted to M. Seguin, a tanner of extensive business, in France, for the first accurate explanation of the rationale of the process of tanning. According to the ancient idea of this process, the effect of the infusion of astringent vegetables, was supposed to be little else than mechanical; and that it acted in *constringing*, or *condensing*, the fibres of the dead skin, as it corrugates the skin of the palate, when tasted; and hence rendered it nearly impervious to moisture, and unsusceptible of putrefaction. This explanation, however, did not accord with the actual increase of weight, which the skin acquires by tanning; and which amounts, on an average, to an increase of from one-third, to one-fourth of the weight of the skin, when dry. M. Seguin, reasoning from the circumstance, that skin, before tanning, is completely resolved, by water, into a liquid jelly, but is insoluble after tanning, was led to the simple experiment of adding a solution of skin, (or glue), to an infusion of oak-bark; and found an immediate precipitate of a thick, tough, extensible, dun-white matter, strongly

smelling of tan, and insoluble in water, at any heat; and which, when dry, becomes of a dark-brown colour, and brittle.

This precipitate, is an intimate combination of gelatin, with that part of the vegetable infusion which gives the tanning property, and being altogether a peculiar substance, is denominated *tannin*, or *tan*. This precipitate, therefore, hardly differs from tanned leather, in any thing but in wanting the fibrous organized texture, and what other principles the skin may have absorbed from the bark infusion, during the maceration of several months, which a sudden precipitation would not effect. Tanning, therefore, consists chiefly in a slow and most intimate combination of vegetable *tan* with the fibre of the skin, which continues till the latter is saturated through its whole thickness.

But oak-bark contains other soluble matter, which certainly also enters the texture of the skin, along with the tan, and most intimately combines with it; for skin, when it has undergone the previous preparation already mentioned, appears to be able to absorb, and when absorbed, to retain, a great variety of vegetable, and animal substances. The infusion of oak-bark, contains, besides tan, the gallic acid, and an extractive matter, all of which contribute to the process, and form a part of the tanned leather. That the gallic acid is absorbed, is proved by the instant blackness which the leather assumes, when merely rubbed with a solution of any salt of iron. The extract appears to be that which gives the leather its colour, and some degree of flexibility; and from the excellent observations of Sir H. Davy, on the process of tanning,* it seems probable that the quantity of tan absorbed, is a good deal regulated by the quantity of extract present; being in general, (the time of immersion, and strength, of the tan-infusion, being nearly equal,) in *inverse* proportion to the quantity of extract, or of mucilage, present in the infusion. This is found, by comparing the actual weight acquired by leather, by quick tanning in infusions of different tanning materials, the composition of which, has been previously ascertained by chymical analysis. The difficulty in experiments of this kind, of obtaining tolerable accuracy, is, however, very great; much greater than in the analysis of metals or minerals, on account of the great want of characteristic marks of distinction between vegetable matters, when a little changed by chymical union with other bodies, and the readiness with which their characters are irrevocably lost, by the common action of reagents.

The strength of the tanning infusion, also, most materially affects the quality of the leather, and the weight which the skin gains during the process. As tan is more soluble than extract, a solution made hastily, and with a large portion of the material, will be nearly saturated with tan, and contains comparatively, but little extract; and on the other hand, the residue of the above infusion, macerated for a longer time in fresh water, will give a solution, in which there is but little tan, but a large quantity of extract. Now it would seem, that skin has the

* Jour. Royal Instit. and Phil. Trans. for 1803.

power of fixing a larger quantity of tan, than of any other material, particularly than of extract; so that if already nearly saturated with extract, it will, of course, absorb much less tan than before; and, therefore, the entire increase of weight, will be much less in this way, than with tan alone. The quality also of the leather, will, of course, be probably different when compounded of skin and tan, with very little other ingredients, than when it is a compound of skin and tan, with a larger proportion of extract; and, in particular, the former seems to be more brittle and less durable than the latter, as far as experiments have been hitherto made. The mere duration of the process, also, as regulated solely by the strength of the infusion, that is, when precisely the same infusion is used, but more or less diluted, may probably, considerably affect the quality of the leather; for when the process goes on very rapidly, it is possible that the outer part of the skin may be tanned strongly, before the inner part is penetrated with the liquor; and as tanning gives a closeness of texture, and difficult permeability to liquids, it may happen that this very circumstance, may prevent that uniformity of saturation with tan, which would seem desirable.

The precipitate, made by a solution of gelatin, dropped into an infusion of any tanning vegetable matter, appeared by Sir H. Davy's experiments, to be tolerably uniform in composition, whatever be the other constituents of the vegetable infusion. Thus, when galls were used, the precipitate contained about forty-six of tan, and fifty-four of gelatin; with catechu, it contained forty-one per cent. of tan; with oak-bark, forty-one per cent.; and with the Leicester willow, forty-three. But real skin, will never acquire such an increase of weight as the solution of gelatin; either because other substances enter into the composition of leather, or because the texture of the skin will not allow it to condense, and chymically unite with so much tan, as the same skin when dissolved in the form of glue; for glue is only a solution of the refuse parts of skin. Thus it was found, that a piece of skin completely tanned, by three weeks immersion in a strong infusion of galls, only gained weight, in the proportion of thirty-nine, to sixty-one, of skin; and this was even the greatest increase of weight observed, (being much more than that of common leather,) and in consequence, made a much harder, and more brittle leather.

With regard to the effect produced by the time of immersion, it was found, in different experiments, that skin, apparently well tanned in each case, absorbed much more tan by rapid, than by slow tanning: one hundred parts of leather, prepared in two weeks, containing seventy-three of skin, and twenty-seven of tan and other materials, absorbed from the oak-bark infusion; and the same quantity of leather, prepared in twelve weeks, (the infusion being proportionably weaker,) containing eighty-five of skin, and fifteen of tan, and other vegetable matter. A similar difference was found, when infusion of willow-bark was employed.

The supposed improvement in the process of tanning, proposed, and actually practised, by M. Seguin, may here be shortly mentioned. This ingenious artist, wishing to abridge the enormous time (and consequent expense,) employed in common tanning, and considering the

tan, as nearly the only active principle in this process, adopted the plan of using solutions of tan, instead of the mixture of bark and ooze, usually employed, and of several and known degrees of strength, in which the skin might be rapidly passed from the weakest to the strongest, by a more regulated gradation than is usually done. For this purpose, he had a series of vats containing the oak-bark, and began by pouring water on one of them, and after a short time drawing it off clear, through a hole at the bottom. This first ooze, was then poured on the bark of the second vat, and drawn off as before; by which it became sensibly stronger of tan. This liquor again was used to the third vat, and again to a fourth, according to the number, till it became quite saturated with tan. In the mean time, fresh water was poured on the bark of the different vats, in the same order, which produced a second ooze, still very strong, but inferior to the first: and thus three or four, or more, different oozes, were obtained, all differing in strength, and which was the tanning liquor employed. The skins then being previously prepared in the way already described, were passed successively through the different oozes, beginning with the weakest and ascending to the strongest, till they were completely tanned, which was known by the disappearance of the white line in the middle of the skin when cut through.

It appears beyond a doubt, that the process of tanning is most materially shortened, by this method of M. Seguin, and that very perfect leather is produced; but though known for several years, it does not appear to be adopted to any extent in this country, where leather is manufactured in vast quantities, both for home consumption, and for exportation to many parts of Europe, in which English leather is in the highest repute. From the way in which the oozes are made, according to M. Seguin, they must, of necessity, contain more tan, in proportion to the extract, and other vegetable matter, than where the bark itself is suffered to remain in substance, along with the ooze and the skin, for many months; as the tan is much the most soluble of all the substances that are to be extracted by water; so that bark may readily be exhausted of tan, long before the extract, resin, gallic-acid, and other materials are got out. It is said that the leather prepared in this new method, is less durable, and more brittle, than in the old way.

The only real improvement, of late, adopted in this part of the process, is, to use some of the oozes warm, by which the skin is sooner penetrated with the ooze, and a saving of time made, of some consequence.

Dr. Mackbride proposes lime-water to be used instead of common water, for the extraction of the tan, from the oak-bark; but this seems to be mischievous, as the only assignable effect of the lime, would be to contract a firm union with a portion of the gallic-acid, and the tan; the result of which would be, an insoluble calcareous substance, utterly unfit for any purposes of tanning.

[TO BE CONTINUED.]

ON IRON AND STEEL.—By THOMAS GILL, No. 3.

On hardening and tempering Springs at one operation.

This is peculiarly applicable to springs made of steel wire, or of sheet steel; and is found to render them considerably more elastic, and less liable to crack in hardening, than by the usual processes. It is effected in the following manner:—The springs are heated to the proper degree for hardening, in a crucible, placed in a proper furnace; and, instead of being quenched in oil or water, they are plunged into a metallic bath, kept over another furnace, at a heat a little below their tempering point, which is ascertained by means of a pyrometer immersed in the bath; and thus they are not cooled entirely, as in the ordinary methods (which renders them exceedingly liable to crack in hardening,) but only to *their proper tempering degree.* The metal for the bath may be plumber's solder, or any alloy of tin and lead, which is capable of fusing, at, or a little below, the proper temperature.—And the pyrometer may consist of a slip of brass, and one of steel, rivetted together, which are secured firmly at one end, to a metal plate forming the basis of the instrument; and, at the other, act on the shorter end of a lever or index, turning upon a pivot or centre, and whose longer end, marks the degrees of heat on a graduated arc, formed upon the surface of the metal plate. The whole should be enclosed in a case, to guard it from being clogged by coming into contact with the lead, and tin. The heat of the bath is lowered, from time to time, as required, by the addition of more of the metal, or by abating the heat of the furnace.*

Our readers will here see a great similarity, in principle, with Mr. Perkins's ingenious method of preventing his steel blocks from warping or cracking, in hardening; namely, by nearly cooling them down to their tempering heat, and not entirely cooling them, as is usual. It was, however, discovered and practised in this country, several years ago; long before Mr. Perkins made known his process, by Mr. James Stone, mechanist, of Warwick street, Golden square, who, in consequence of the great loss sustained by hardening and tempering his

* The pyrometer above-mentioned is an instrument intended to measure degrees of heat, higher than those which can be ascertained by the mercurial thermometer. The principle upon which its action depends, is the difference of expansion in metals of different kinds, by equal increments of temperature; when, therefore, the slips of brass and steel are rivetted together at the ordinary temperature, and are afterwards heated; the brass by its greater expansion, will cause a curvature in the rod, which will be proportioned to the degree of heat employed; the degree in which it is bent, and consequently its temperature, may be shown by means of an index, to which it, in bending, may give motion.

A little attention, we are convinced, will render the use of this instrument unnecessary, as the metallic alloy may be made fusible at the requisite temperature, and care must then be taken that it should be just hot enough to preserve its fluidity; this is readily known by its tendency to harden round the edges of the mass. In mechanical operations it is of great importance to simplify every process, as without this, the difficulties which present themselves, will prevent its general adoption.—Editor.

springs in the usual method, was forced, from necessity, to adopt a better; and was fortunate enough to discover the above; accidents now seldom happen in hardening and tempering his springs. It should, however, be mentioned, that he finally quenches them in oil, and blazes them off, as usual, in order to secure their toughness, and to coat them with a sort of oily varnish, to guard them from rust.

On restoring the elasticity of hardened and tempered Steel Articles.

Saws, sword-blades, clock and watch-springs, &c. which, after being hardened and tempered, require to be ground and polished, or otherwise brightened, lose their elasticity or springiness in those operations, so as to appear soft on bending them, although they are as hard as ever: these qualities are again restored to them, either by heating uniformly over a clear fire made of cinders, urged by bellows, or over the flame of burning alcohol, or by inclosing them in a smouldering fire made of wood-ashes and embers, to a blue colour: which colour may either remain, or be removed by the application of diluted muriatic acid, as before described in p. 80 of our last number.

On the partial conversion of Iron, into Steel.

It is frequently highly desirable, to form articles of iron, which may afterwards be superficially converted into steel. In the instance of rasps for the use of sculptors, it is indeed particularly necessary; as thereby, whilst the teeth on their surfaces, are as hard as usual, the rasps admit of being bent into any form of curvature, suitable to the intended purposes. The Editor, through the kindness of that eminent sculptor, the late Mr. James Smith, is now possessed of a half-round rasp, made in Italy, which fully possesses the admirable qualities above alluded to; and indeed, during the late war, such rasps were become exceedingly scarce and dear. Now it is evident that such rasps need only be made of iron, and their surfaces afterwards case-hardened in a slight degree, entirely to resemble the Italian rasps.

A similar advantage is likewise obtained, in forming slender articles of pure iron; such as that afforded by decarbonating cast-steel, and afterwards case-hardening them slightly; as thereby, their surfaces are fitted to receive a high polish, whilst their interior, still continues soft and tough; and, therefore, the articles are less liable to break in use, than if they were made of steel, or case-hardened throughout.

On Horse-nail-stub Iron, for gun-barrels, official seals, stop-cocks, &c.

Old horse-nails, which, to be fit for use, are necessarily made of the softest and toughest iron, are collected throughout the country, on purpose for this use: these are first agitated and rubbed against each other, in an angular box of iron, turning round continually, until the greatest part of the rust, which was upon them when collected, is rubbed off: they are then straightened, and driven tight into hoops of iron, with the heads and points opposite to each other, till the hoop will hold no more; when the mass is fit for being welded, and drawn out into bars, or into any other form, for use, as a very soft veined

iron, for making twisted gun-barrels and large office-seals, which latter, after being engraved, are case-hardened; and also for making stop-cocks, and other apparatus for performing experiments in chymistry, wherein mercury is employed, and the use of brass must be consequently excluded.

Improved mode of making Twisted Gun-barrels.

Instead of using horse-nail-stub iron alone, as in the last article, the gun-barrel makers now weld together bars of steely iron; such as the old sable Russian iron, and soft stub-iron, laid alternately upon each other in regular order; thus forming striped ribbands for the twisted barrels.

Where they wish, however, to produce curls, they first twist those compound bars, draw them into small square rods, and weld them, with the twists disposed in contrary directions, upon plates of plain iron, which forms the inside of the barrels; when the whole is drawn into ribbands, and used as before described.

Another beautiful variety is also produced by welding small square rods of striped iron, and others of twisted iron, upon plates of plain iron; thus producing a regular succession of striped and curled twists in the gun-barrels made thereof.

On annealing Iron and Steel, without oxiding or scaling it.

This is done by inclosing it in closed cast-iron vessels, and surrounding it with ground flint, such as is used in the manufactory of pottery; and then exposing the vessels to a red heat, in proper furnaces. It is likely that fine loam, might also answer for this purpose.

In this manner, Mr. Corcoran, of Mark-lane, wire-weaver, many years since, annealed his iron-wire so perfectly, that, although quite flexible, and pliant, yet it was as bright as though it had not been heated at all.

Another method is, to inclose it in melted lead, in cast-iron vessels; the surface of the lead being covered with charcoal, to prevent oxidation; and to let it nearly cool, before taking out the iron or steel. In this way, the late Mr. John Burr, millwright, of Halesowen, in Shropshire, annealed steel-wire for the needle and fish-hook makers.

ENGLISH PATENTS.

To WILLIAM CHURCH, *of Birmingham, in the county of Warwick, Esq. for his invention of certain improvements in Machinery for Printing.*

In our sixth volume, we have given plates, and descriptions, of the very ingenious apparatus, invented by Dr. Church, for casting types, composing them into words and sentences, and afterwards printing the sheets of paper therefrom. The peculiarity of this invention, has

called forth considerable animadversion; and the public press, has treated it with no small portion, both of ridicule and applause; in many instances, equally resulting from an utter ignorance of the merits of the subject. A long procrastination, in bringing this invention into public use, has now caused it to sleep, (as many think, an "eternal sleep,") like some other subjects, which, perhaps, we may shortly revive, and send forward again to the light of day. It cannot, however, be a matter of surprise, that in surmounting the practical difficulties, which must present themselves, in the completion of machinery, that contemplates an extensive range of objects, considerable time should have elapsed; many instances occur in the annals of mechanical art, in which inventions, founded upon the most indisputable principles of science, have never been realized, during the lives of their projectors. The steam-engine of Watt, was not brought to perfection, until the whole term of his patent-right had expired! It is, therefore, incumbent upon the public, to bear patiently, such delays as result from the unforeseen difficulties, to which almost every inventor is exposed, in bringing his views to perfection; and to wait the period, however protracted, when the bright hopes of the aspiring genius, shall at length blaze out into maturity.

We have, involuntarily, been led to these general remarks, by the recollection of the contemptible ridicule, on the one hand, and the fulsome commendations on the other, to which Dr. Church's inventive talents, have been exposed, in the public prints; and without intending to apply those remarks personally, have adopted them as a preface to the following subject.

The present patent, is for improvements, upon that part of the invention above alluded to, which comprises the printing press. The publication of this subject, has been delayed, under the expectation of being enabled to speak practically of its usefulness. We have now to state, that we have seen a printing press in operation upon this improved principle, which gives impressions equal to the best works of the most approved printing presses, and with a rapidity that is really surprising. We carefully watched its operation, for some time, when working under the disadvantage of inexperienced hands, and are in possession of a few sheets which were then printed at the rate of eighteen hundred per hour: we have no hesitation in saying, it is our firm belief, that, under favourable circumstances, three thousand impressions, per hour, might be struck off, without, in any degree, straining the machinery, and that these impressions would be of a superior order of printing.

The machine is worked by one man, who turns the fly-wheel, and two boys, who lay on the sheets of paper; the inking of the types, the running in of the frisket, the rising and falling of the table and form, to produce the impression, and the delivery of the sheets, after being printed, into a heap, above the press, are all done by the evolutions of the mechanism; which is so substantial, in all its parts, that there is little risk of its derangement; and the movements are so smooth, that its action would scarcely be perceived in an adjoining room, or at a few yards distance.

The specification states, that these "improvements in machinery for printing, consist in variations, additions, and modifications of an apparatus for printing, described in the specification of a patent, &c. granted 21st of March, 1822." The improvements are embraced under the following heads: 1st, a method of adjusting and fixing the form of types upon the table, and of removing the same, and replacing other forms of types, with great expedition; 2dly, adapting a stationary surface, upon which, the paper intended to be printed, is laid and adjusted, ready to be drawn off, on to the frisket; 3dly, a mode of obtaining register with perfect accuracy; 4thly, the means, and apparatus, employed for confining the sheet of paper upon the frisket; 5thly, an interrupted gear motion, or mechanical contrivance, to effect a reciprocating action, by which certain parts of the machinery are alternately put in motion, or set at rest, while the other parts of the machinery, are continuing their progress; 6thly, the mode of taking off the sheet of paper, after it has been printed, and delivering the sheets, in succession, on to a heap, with perfect regularity; and 7thly, the mode of regulating, at pleasure, the quantity of ink communicated to the distributing rollers.

[*London Journal of Arts and Sciences.*

To JOSEPH ASPDIN, *of Leeds, in the County of York, Bricklayer, for his new invented improvement in the mode of producing an artificial Stone.*

This cement or artificial stone, is proposed for the covering of buildings as stucco, and is suited either for dry situations or for water-works. The patentee designates the material PORTLAND CEMENT, from its resemblance to Portland stone; its component parts are as follow: a given quantity of lime-stone, of the kind usually employed for mending roads, is to be pulverized by beating or grinding, or it may be taken from the road in a pulverized state, or in the state of puddle. This, when dried, is to be calcined in a furnace in the usual way. A similar quantity of argillaceous earth or clay is then to be mixed in water with the calcined lime-stone, and the whole perfectly incorporated by manual labour, or by machinery, into a plastic state. This mixture is then to be placed in shallow vessels for the purpose of evaporation, and is to be submitted to the action of the air, the sun, or the heat of fire, or steam conducted by pipes, or flues under the pans or evaporating vessels.

This composition, when in a dry state, is to be broken into lumps of suitable sizes, and is then to be calcined again, in a furnace similar to a lime-kiln, till the carbonic acid has been entirely expelled. The mixture so prepared, is then to be pulverized by grinding or beating, and when reduced to a fine powder, is in a fit state for use; and, with the addition of so much water as will be sufficient to bring

it into the consistency of mortar, will, when applied to its purpose, make a compact and durable artificial stone, equal to the Portland stone itself.

To JAMES RUSSEL, *of Wednesbury, in the County of Stafford, Gas Tube Manufacturer, for his invention of an improvement in the manufacture of Tubes for Gas and other purposes.*

These improvements, appertain to the peculiar mode of forming pipes and tubes of malleable iron, as practised by the patentee. He states, that he provides iron plates, previously rolled to a suitable thickness, and cut into strips of such length, as may be found desirable to constitute one piece of pipe or tube; the breadth of the strip, corresponding to the circumference of the tube intended to be formed.

The sides of the slips are then bent up by swages, or otherwise in the usual way, so as to bring the two edges as close together as possible.

This bent iron, or imperfect tube, is then introduced into a blast furnace, and when brought nearly into a state of fusion, is removed, and placed under a tilt hammer, for the purpose of welding the joint. The anvil, or the bolster fixed into the anvil upon which the tube is to be placed, has a semi-cylindrical groove formed in it, and the under side of the hammer has a corresponding groove. The imperfect tube is now slowly passed along under the tilt hammer, and by a succession of blows, the edges of the plate-iron become welded from end to end, and the tube rudely formed. The action of the tilt hammer is effected as usual; it vibrates upon pivots, and by the rotation of a wheel with projecting arms or cogs, which strike successively upon the end of the hammer, it is raised, and falling by its own gravity, produces the repetition of blows.

When the edges of the iron have been thus completely welded from end to end, the tube is to be again heated in a furnace as before, and then passed through a pair of grooved rollers. These rollers may have several circular grooves, suited to tubes of different diameters. The end of the tube, immediately as it comes out from between the rollers, is met by a conical or egg-shaped core, placed at the extremity of a stationary, horizontal rod, which egg-shaped core enters the open end of the tube, as it advances from between the rollers, and by sliding upon this core, the internal part, or bore of the tube, is formed to the exact diameter of the core, and rendered perfectly smooth; its external form, being determined by the grooved rollers.

The advantages which are proposed by this mode of manufacturing tubes and pipes, of wrought iron, for conveying gas, and other purposes, are, that the internal and external surfaces of the tubes will be perfectly cylindrical, and parallel to each other; and that the irregularities, occasionally arising from scales, and other obstructions, will be altogether avoided. The claim of invention, therefore, is not to be

considered as resting in the implements used in the operation, which are not new in themselves, either in form or character; but in the mode of operating, which, as respects the formation of pipes and tubes of malleable iron, is new.

To CORNELIUS WHITEHOUSE, *of Wednesbury, in the county of Stafford, Whitesmith, for his invention of certain Improvements in manufacturing Tubes for Gas, and other purposes.*

The present patent is for improvements upon the above process, invented by a workman in the employ of Mr. James Russell, in whom, we understand, the interest of this patent is now become vested; Mr. James Russell is, therefore, the only manufacturer of these tubes.

The improvement consists in heating the pieces of iron of which such tubes are to be made, in a blast furnace, and immediately after withdrawing them from the furnace, passing them through swages, or other such instruments, in the following manner. First, provide a piece of flat iron, commonly called plough-plate iron, of a suitable substance, and width, according to the intended caliber of the tube; this piece is then prepared for welding, by being beat up on the sides, or, as it is commonly called, turned over, the edges meeting, or nearly so, and assuming the form of a long, cylindrical tube. This tube is then to be put into the fire and heated by a blast, and when the iron is upon the point of fusion, it is to be drawn out of the furnace by means of a chain attached to a draw-bench, and passed through a pair of dies of the size required; by which means, the edges of the iron will become welded together.

It is stated, that the process of welding these tubes, may be performed without the screw-press and dies above described, by employing a pair of pincers, in which a conical hole is made between the two chaps, for the tube to pass through; which will have a similar effect to the dies.

The superior quality of these tubes, compared to those made in the ordinary way, is stated to arise from the iron being considerably improved by the operation of the hollow fire, by which the heat is generally diffused through every part. The length of the pieces of tube thus made, is likewise an advantage, as by the above means, pipes or tubes may be made from two to eight feet long, in one piece; whereas, by the old modes, the lengths of tube cannot exceed four feet, without considerable difficulty, and consequently an increased expense. It is further stated, that the tubes are capable of resisting greater pressure, from the uniformity of the heat throughout, when they were welded; and lastly, that both their internal and external surfaces are rendered smooth, and greatly resemble drawn lead-pipes.

To ALEXANDER NESBITT, *of Upper Thames street, in the City of London, Broker, in consequence of a communication made to him by* WILLIAM VAN HOUTEN, *the younger, a foreigner, residing abroad, for a process, by which certain materials may be manufactured into Paper and Felt, or a substance nearly resembling coarse Paper or Felt; which material, so prepared, is applicable to various useful purposes.*

The material to be employed for this purpose, is moss, such as grows upon low heaths, and moors, in Holland; and which may be found, as the patentee supposes, in many parts of England. This moss is to be gathered, washed, cleaned, and dried, and then cut into short lengths in an engine, such as is employed for cutting tobacco. The cut moss, is then to be mixed up in the manner of preparing pulp, for making paper; and, when so mixed, is to be moulded into sheets, in a frame, as paper is moulded. The sheets are then to be pressed, in a heap, between blankets, and afterwards hung up to dry upon lines, as paper. When perfectly dry, the sheets are to be again pressed, in order to bring the material into close contact; and they may then be considered as fit for use.

This paper, or felt, is proposed to be employed for sheathing of ships' bottoms, between the wood-wook and the copper; and also for lining between the thicknesses of planking: it is proposed as an infallible preventive against leaking; as, upon the insinuation of water between the joints of the copper, or wood-work, this felt, or paper, will absorb the wet as a sponge, and thereby swelling, will fill the vacant spaces, and render the vessel water-tight.

Such a material has been employed, for some time, in the Dutch navy, and has been found perfectly efficacious in keeping the vessel dry; and so extremely durable is moss, that the patentee considers it will never decay, but will remain sound and effective as long as the wood-work of the ship lasts.

FOR THE FRANKLIN JOURNAL.

MECHANICAL JURISPRUDENCE.—No. III.

BY PETER A. BROWNE, ESQ.

ON MECHANICS' LIENS.

Having in the last number, enquired who are the parties to the contract, we shall next consider,

The persons with whom the contract is made.

The law of 1803, as I before mentioned, was a little defective in some of its provisions.

In order to create a lien, it required that the contract should be made with the *real owner*. The words are, "shall be subject to the payment of the debts contracted by the *owner* or *owners* thereof."

And, therefore, in the case of Steinmetz's Executors, *v.* Boudinot,

3 Sergeant and Rawle, 541, it was decided by the Supreme Court, that this act gave no lien, where the materials were furnished, by the orders of a person who had entered into articles of agreement with the owner of the land, for the purchase of the same, and was erecting the building; although such agreement was unknown to the plaintiff, and the defendant was ostensibly the owner of the building. The case was this, Boudinot was the owner of a lot; he contracted with one Bartle, by articles of agreement, to convey it to him on a ground rent at $5 a front foot; Bartle erected the building, and, in so doing, contracted the debt due to Steinmetz, which was for bricks used in the construction. The agreement made between Boudinot and Bartle was unknown to Steinmetz, at the time of the contraction of the debt. Bartle, was the ostensible owner, both of the ground and the building.

The next observation necessary to be made upon this law, (1806) is, that the words, "by the owner or owners thereof," found in the law of 1803, and upon which the difficulty took place, in the case of Steinmetz, *v.* Boudinot, before noticed, are omitted. There can be little doubt, but these words were *purposely* omitted by the legislature of 1806.

The act of 1803 reads thus, "That all, and every dwelling house, or other building, hereafter constructed and erected within, &c. shall be subject to the payment of the debts contracted '*by the owner or owners thereof*,' for, or by reason of, any work," &c.

That of 1806, thus, "That all and every dwelling house, or other building, hereafter constructed and erected within, &c. shall be subject to the payment of the debts contracted for, or by reason of, any work," &c.

Consequently, the decision in Steinmetz, *v.* Boudinot, that in order to create a lien under the law of 1803, the contract must have been made with the *real owner* of the building, does not apply to cases under the law of 1806. Under this latter law, it matters not whether the contract was made with the *real owner*, or not. Chief Justice Tilghman in delivering the opinions of the court in the case of Steinmetz, *v.* Boudinot, on this point, expresses himself in the following manner:—"When this act (of 1803) was made, it was very common for the proprietors of ground, to contract with a mechanic, of character, for the building of a house. The proprietor paid a certain sum of money for the building, when completed; and the mechanic purchased materials, and built the house, *on his own credit*. Now it is very clear, that in such case, the act (of 1803) created no lien.—This was found to bear hard in some instances, on persons who had furnished materials, or done work on a house; and therefore, by a subsequent act (passed March 17, 1806,) the lien was extended to all cases of work done, or materials furnished for a building, *whether on the credit of the owner or not*."

The *subject matter* of the contract:—

1. Repairing.
2. The actual use of the articles.
3. The contract of exchange of labour or materials.

By the words of the law, "all and every *dwelling house* or *other*

building," every edifice that can be erected, whether church, dwelling-house, barn, stable, or out-house, are included; and therefore, upon all of them, a lien may be created. But the debt must be contracted in the *erecting* and *constructing* of the house or other building, and no lien is created for *repairing* a building.

The words of the law are, "All and every dwelling-house or other building, hereafter *constructed* and *erected*, &c." And again, "for, or by reason of, any materials found, or work done for, or in the *erecting* and *constructing* such house or other building, &c."

And hence, in the case of the Olympic Theatre, 2 Browne, rep. 275, 284, it was decided that the act of *repairing* a building, or furnishing materials for that purpose, created no lien.

Under ordinary circumstances, it is very easy to determine, whether the work is done, or materials furnished for *repairing*, or for *erecting;* but cases may occur, when it will be difficult to come to a determination. For instance: suppose a part of a building were torn down and rebuilt; would this be repairing an old building, or constructing a new one? The answer to this question depends upon the construction to be put upon the words *erecting* and *constructing*; and that again depends upon the character of the statute in which they are found. One of the rules laid down, for the construction of statutes, is, that remedial statutes, or statutes against frauds, are to be liberally, and beneficially expounded: for although in *penal statutes*, a strict construction is required, by that humane principle of the law, which prefers that the judge should *acquit*, whom the legislature intended to *punish*, than that he should *punish*, whom the legislature intended to *discharge;* yet in giving relief against fraud, or in the furtherance and extension of natural right and justice, the judge may safely go beyond that which existed in the minds of those who framed the law. Now this is a *remedial* statute, of the most equitable kind, guarding an industrious and valuable part of the community, against the frauds, which were before, so often practised upon them; and giving them that security, which, above all others, is the most equitable—namely, upon the *thing* created by their labour and materials; in its construction, therefore, the judges have a *right* to be *liberal;* and it requires no great stretch of generosity to say, that where the *principal* part of a building is torn down, and rebuilt, it is a *construction* of a building.

Accordingly, in the case of the Olympic theatre, where the gable end of the old building was torn down, and a large additional building, communicating therewith, was erected, we find Judge Hemphill expressing himself as follows: "The court are further of opinion, that the act of *repairing* a house, creates no lien within the meaning of the legislature." "If the *principal part* of a building should be torn down, and rebuilt, upon a liberal construction of the act, it ought to be considered as creating a lien."

2. The actual use of the articles.

It is not necessary, in order to create a lien, that the materials should have been *actually used in the building;* if they are delivered

at, or *near* the building, at the place pointed out by the contracting party, *with an understanding of the parties, that they are to be used* in the *erection thereof*, a lien will be created in the building, although the articles are not used therein. The law does not require, *in terms*, that they should be used *in* the building; for it is in the alternative, "materials *for*, OR *in the erecting* and constructing," &c.; and the plain common sense, and common justice of the case require, that the honest mechanic, or material man, who has acted with the usual prudence exercised by men in his situation, should not be defeated of his lien by the fraud of others, not subject to his control.

The case of Wallace, *v.* Melchoir, was this: The defendant contracted with the plaintiff, who was a lumber merchant, for a quantity of lumber, to be used in the erection of a building. The lumber was delivered, from time to time, *at the building*; but was not used in the construction thereof; being, without the knowledge of the plaintiff, sold and delivered by the defendant, to different persons. The plaintiff entered his lien, agreeably to the act of Assembly. Hemphill delivered his opinion to the jury, as follows: "If you are satisfied, that Wallace's debt was contracted *for*, and on the *credit* of, the building; and that the lumber was delivered *at*, or *near*, the building, at the place pointed out by the defendant, *with an understanding of the parties that it was to be used in the erection thereof:* if, after that, the defendant did not use the lumber in the building, but, without the knowledge or consent of the plaintiff, sold it to other persons, still Wallace had a lien on the building for his debt."

And if the materials are not even furnished, *at* or *near* the building, but at a distance from it, *provided it is in the usual course of business*, a lien is effected on the building, although they are not actually used therein. The material man, having, *bona fide*, sold the articles *for* the erecting of the building, and delivered them *in the usual course of trade*, for instance lumber at the carpenter's shop, he is not obliged to incur the risk of their application.

This was decided in the case of Hinchman, *v.* Graham. 2nd Sergeant and Rawle's Reports, 170.

ON SPECIFIC GRAVITY.—No. III.

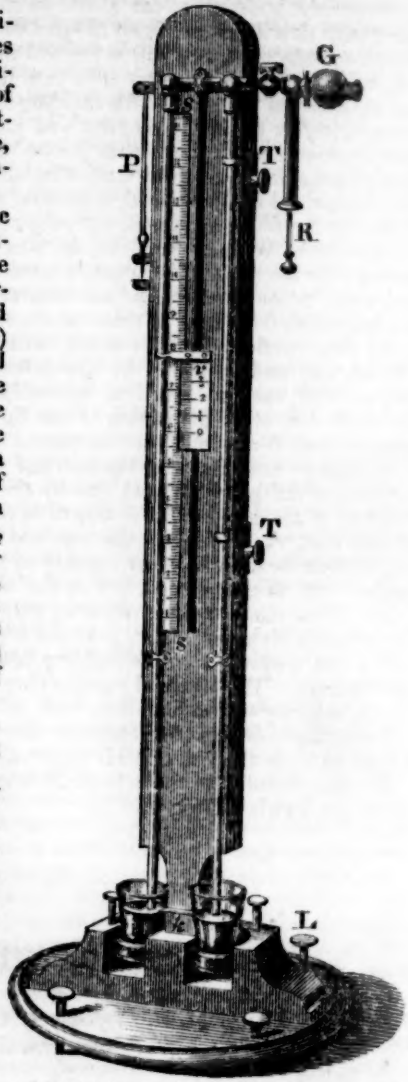
By ROBERT HARE, M. D. *Professor of Chymistry in the University of Pennsylvania.*

ON THE LITRAMETER.

This name is derived from the Greek litra, weight, and meter, measure; and is given to one of the instruments which I have contrived for

ascertaining specific gravities. The litrameter owes its efficiency to the principle, that when columns of different liquids are elevated by the same pressure, their weights must be inversely as their gravities.

Two glass tubes, of the size and bore usually employed in barometers, are made to communicate internally, with each other, and with a gum elastic bag, (G) by means of a brass tube and two sockets of the same metal, into which they are severally inserted. The brass tube terminates in a cock, to which the neck of the bag is tied. Between the cock and the glass tubes, there is a tube at right angles to, and opening into, that which connects them. At the lower end of this tube, a small copper rod (R) enters, through a collar of leathers.



The tubes are placed vertically, in grooves, against an upright strip of wood, tenanted into a pedestal of the same material. Parallel to one of the grooves, in which the tubes are situated, a strip of brass is fastened; and graduated, so that each degree may be about equal to $\frac{1}{220}$ of the whole height of the tubes. The brass plate is long enough to admit of about 140 degrees. Close to this scale, a vernier (v) is made to slide, so that the divisions of the scale are susceptible of sub-division into tenths, and the whole height of the tubes, into about 2200 parts, or degrees.

On the left of the tube, there is another strip of brass, with another set of numbers, so situated, as to comprise two degrees, of the scale

above-mentioned, in one. Agreeably to this enumeration, the height of the tubes is, by the aid of a correspondent graduation on the vernier, divided into 1100 parts, or degrees.

A small strip of sheet tin, (*k*) is let into a kerf in the wood, supporting the tubes, in order to indicate the commencement of the scale; and the depth to which the orifices of the tubes must extend. At distances from this, of 1000 parts, and 2000 parts, (commensurate with those of the scale) there are two other indices, (T, T,) to the right hand tube. Let a small vessel, containing water, be made to receive the lower end of the tube, by the side of which the scale is situated; and a similar vessel of any other fluid, whose gravity is sought, be made to receive the lower end of the other tube; so that the end of the one tube, may be covered by the liquid in question, and the end of the other tube, by the water.

The bag being compressed, a great part of the contained air, is expelled through the tubes, and rises through the liquids in the tumblers. When the bag is allowed to resume its shape, the consequent rarefaction allows the liquids to rise into the tubes, in obedience to the greater pressure of the atmosphere, without. If the liquid to be assayed, be heavier than water, as, for instance, let it be concentrated sulphuric acid, it should be raised a little above the first index, at the distance of 1000 degrees from the common level of the orifices of the tubes. The vessels holding the liquids, being then removed, so that the result may be uninfluenced by any inequality in the height of the liquids, the column of acid must be lowered, until its upper surface coincide, exactly, with the index of one thousand. Opposite the upper surface of the column of water, the two first numbers of specific gravity of the acid, will then be found; and, by duly adjusting and inspecting the vernier, the third figure will be ascertained. The liquids should be at the temperature of sixty.

If the liquid under examination, be lighter than water, as in the case of pure alcohol, it must be raised to the upper index. The column of water, measured by the scale of 1000, will then be found at 800 nearly; which shows, that 1000 parts of alcohol, are, in weight, equivalent to 800 parts of water—or, in other words, 800, is ascertained to be the specific gravity of the alcohol.

The sliding rod and tube at R, between the cock and the glass tubes, facilitates the adjustment to the index, of the column of liquid in the right hand glass tube. When the rod is pushed in, as far as possible, it causes a small leak, by which the air enters; and the columns of the liquids, previously raised too high, by the bag, may be allowed to fall, till the liquid, which is to be assayed, is near the index. Then, by pushing the rod in, they may be gradually lowered, and adjusted to the proper height, with great accuracy.

A rod of this kind, graduated, might answer the purpose of a vernier.

Instead of a simple bag of Caoutchouc, I have used one with two valves; one opening from the tubes into the bag, the other, from the bag, into the air.

But upon the whole, I find a syringe preferable; the adjusting rod being included in the rod of the piston, which is perforated for its reception, and furnished with a stuffing box, to render it air tight.

The plummet P, and the screws at L, enable the operator to detect, and rectify any deviation in the instrument, from perpendicularity.

Erratum in the first number of this Journal.—In page 45, line 13th from the bottom, for "the weight of this, divided by the weight of the others," *read*, dividing by the weight of this, the weights of the others.

An account of the Hydrostatic Blowpipe, as now used in the Laboratory of the University of Pennsylvania, by the inventor, R. HARE, *M. D. Professor of Chymistry, &c.*

The following passage is quoted from a memoir on the supply and application of the Blowpipe, which I published in 1802:—

"The blowpipe is, on many occasions, a useful instrument to the artist, and philosopher. By the former, it is used for the purpose of enamelling, to soften or solder small pieces of metal, and for the fabrication of glass instruments; while the latter, can, by means of it, in a few minutes, subject small portions of any substance to intense heat; and is thus enabled to judge of the advantage to be gained, and the method to be pursued, in operations on a larger scale. It is by means of the blowpipe, that glass tubes are most conveniently exposed to the heat necessary to mould them into the many forms occasionally required, for philosophical purposes; and by the various application of tubes, thus moulded, ingenuity is often enabled to surmount the want of apparatus; which is the greatest obstacle to the attainment of skill, in experimental philosophy.

"To all the purposes which I have mentioned, the blowpipe is fully adequate, when properly supplied with air, and applied to a proper flame: but it appears that the means which have hitherto been employed to accomplish these ends, are, more or less, defective.

"The most general method, is that of supplying this instrument with the breath. In addition to the well known difficulty of keeping up a constant emission of air during respiration, and its injurious effect upon the lungs,* it may be remarked, that as the breath is loaded with moisture, and partially carbonized, it is proportionably unfit for combustion; and, the impossibility of supporting a flame with oxygen gas, by this method, is obvious.

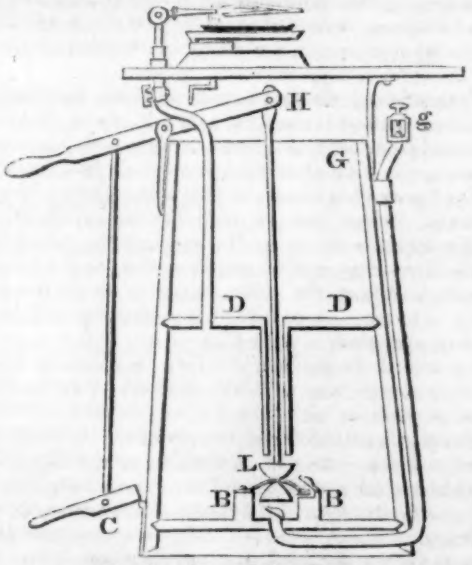
"Another way of supplying the blowpipe with air, is that of connecting with it, a small pair of double bellows. A contrivance of this kind, possesses obvious advantages over the mouth blowpipe; but, owing to the pervious nature of the materials of which bellows are constructed, and the difficulty of making their valves air tight, the greater part of the air drawn into them, escapes at other places than the proper aperture. A pair of bellows, of this kind, belonging to an artist of this city, which were not considered as less air tight than usual, were found to discharge the complement of their upper compartment, in six-sevenths of the time, when the orifice of the pipe was open, which was requisite when it was closed. Hence, it appears that

* In consequence of this, some artists have abandoned the use of the instrument.

six-sevenths of the air ejected into the upper compartment, escaped at other places than the proper aperture; and if to this loss were added that sustained by the lower compartment, the waste would be much greater. As in operating with these machines, it is necessary constantly to move the foot, the operator cannot leave his seat; and, in nice operations, the motion of his body is an inconvenience, if not a source of failure. Bellows of this kind cannot be used for supplying combustion with oxygen gas; because, as this air is only to be obtained by a chemical process, it is very desirable to avoid any waste of it; and, as there is always a portion of air remaining in them, even when the boards are pressed as near to each other as the folding of the leather will permit, any small quantity of oxygen gas which might be drawn into them, would be contaminated.

"Being sensible of the advantage which would result from the invention of a more perfect method of supplying the blowpipe with oxygen gas or atmospheric air, I was induced to search for means of accomplishing this object. The result of my attention to the subject, is the production of a machine, of which there follows an engraving and description."

The machine, which the following figure represents, does not differ essentially from that alluded to, in the passage above quoted. The construction is, however, more simple and easy.



Explanation of the figure.

The *Hydrostatic Blowpipe*, consists of a cask, divided by a horizontal diaphragm, into two apartments (DD.) From the upper apartment, a pipe of about three inches in diameter, (its axis coincident with that of the cask,) descends, until within about six inches

of the bottom. On this is fastened by screws, a hollow cylinder of wood (BB.) externally twelve inches, internally eight inches, in diameter. Around the rim of this cylinder, a piece of leather is nailed, so as to be air tight. On one side, a small groove is made in the the upper surface of the block, so that a lateral passage may be left under the leather when nailed on each side of the groove. This lateral passage, communicates with a hole bored vertically into the wood, by a centre-bit; and a small strip of the leather, being extended so as to cover this hole, is made, with the addition of some disks of metal, to constitute a valve, opening upwards. In the bottom of the cask, there is another valve, opening upwards. A piston rod, passing perpendicularly through the pipe, from the handle (H,) is fastened near its lower end, to a hemispherical mass of lead (L.) The portion of the rod beyond this, proceeds through the centre of the leather, which covers the cavity formed by the hollow cylinder; also through another mass of lead, like the first, which being forced up by a screw and nut, subjects the leather, between it, and the upper leaden hemisphere, to a pressure sufficient to render the juncture air tight. From the partition, an eduction pipe is carried under the table, where it is fastened, by means of a screw, to a cock which carries a blowpipe, so attached, by a small swivel joint, as to be adjusted into any direction which can be necessary. A suction pipe passes from the opening covered by the lower valve, under the bottom of the cask, and rises vertically, close to it, on the outside—terminating in a gallows, (g) for the attachment of any flexible tube which may be necessary.

The apparatus being thus arranged, and the cask supplied with water, until the partition is covered, to the depth of about two inches, if the piston be lifted, the leather will be bulged up, and will remove, in some degree, the atmospheric pressure from the cavity beneath it; consequently, the air must enter through the lower valve, to restore the equilibrium. When the piston is depressed, the leather being bulged, in the opposite direction, the cavity beneath it is diminished, and the air, being compressed, forces its way through the lateral valve into the lower apartment of the cask. This apartment being previously full of water, a portion of this fluid is pressed up, through the pipe, into the upper apartment. The same result ensues every time that the stroke is repeated; so that the lower apartment soon becomes replete with air, which is retained by the cock, until its discharge by the blowpipe is requisite.

The cock being opened, the air confined in the lower apartment, is expelled by the pressure of the water in the upper apartment, which, as the air which had displaced it escapes, descends and re-occupies its former situation. The piston is worked either by the handle, or the treadle, at C.

In order to supply the cask with oxygen gas, it is only necessary to attach to the suction pipe, (by means of the gallows and screw at g,) another pipe, duly flexible, and passed under a bell containing the gas in question, over the pneumatic cistern. Or the pipe may communicate with a leather bag, filled with oxygen. I have one, which will hold fifty gallons; the seams are closed by rivets, agreeably to Pennock & Sellers' plan for mail bags, or fire-hose.

Having used the Hydrostatic Blowpipe for five and twenty years, I am enabled to speak in favour of its conveniency, with the confidence due to this long trial. I am persuaded, that it would be found exceedingly useful, to all artists who employ the blowpipe in soldering, or in blowing, or moulding the tubes of thermometers, barometers, and other processes, to which the enamellers' lamp is applied.

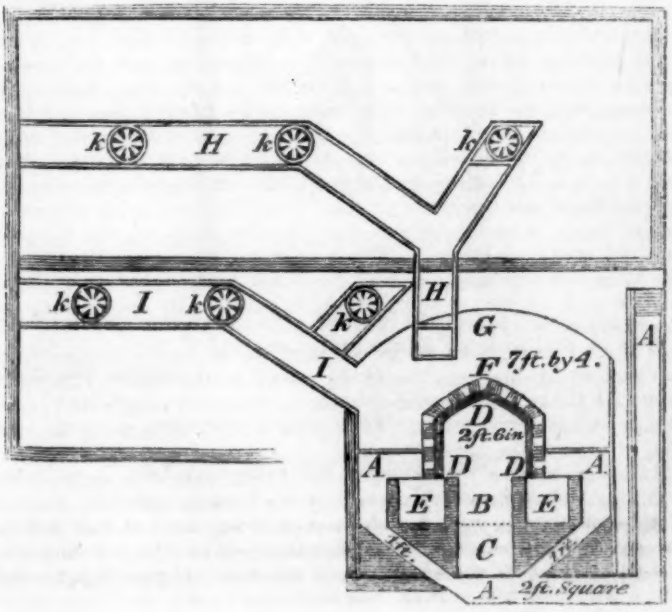
Associated with the large self-regulating reservoir of hydrogen, to be described in the next number of this Journal, it is, with the aid of a jet of atmospheric air, supplied to it in the compound blowpipe, competent to fuse platina; and the facility with which the hydro-oxygen flame thus produced, may be made to act in any convenient direction, would render it highly serviceable to silversmiths, coppersmiths, and pewterers. In soft soldering, it is often far more efficacious than a soldering iron. Its peculiar cleanliness is worthy of attention; in this respect, it greatly excels the ordinary blowpipe flame. Besides, the limits are peculiarly ample, within which it is susceptible of an instantaneous increase, or diminution, in size or intensity.

I do not believe the heat produced in this way, to be much more expensive than that produced by a lamp.

[TO BE CONTINUED.]

WARMING ROOMS BY HEATED AIR.

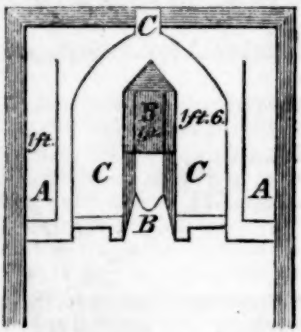
The following mode of warming large rooms, with hot air flues, is very economical, and has had its utility established by the ordeal of a fair trial.



For eight years I did business, daily, in a room 70 feet by 30 feet, and, during winter, with two very large fires; but the room was never comfortably warm ten yards from the fires. The mode of heating by flues was then adopted; and the same room, as well as another, 60 feet by 21, has been ever since, (now more than four years,) kept at a regular heat of 55 degrees by one fire, which supplies the flues with hot air. The saving in fuel is very great; while four fires, on the old plan, for the two rooms, would consume twenty chaldrons yearly, this method requires only eight chaldrons, making a saving of twelve. The whole expense of laying down the flues, building the cellar, &c. was about one hundred pounds sterling.

The following rough description will, perhaps, make the mode of proceeding clear to your readers:

The drawing prefixed to this article, shows the two rooms, one 70 feet by 30, and to the square of the roof 18 feet; the other, 60 feet by 21, and to the square of the roof 12. Also, a third apartment, (the cellar beneath,) containing the fire-place that furnishes the hot air to the rooms. A, is the cold air flue; B, fire-place; C, ash-place; D, iron retort; E, smoke flue; E, 4½ inches brick-work round the retort, with small pots, similar to chimney-pots, 2 inches in diameter, to admit the cold air to the retort, and to let it into the hot air chamber, when heated; G, the hot air chamber; H, hot air flue into the large room; I, ditto into the small room; K, ventilators to regulate the heat.



The additional figure here inserted, is an elevation of the fire-place. A is the cold air flue; B, the fire-place; and C, the smoke flue.

[*English Magazine.*

ON THE FIGURE OF THE EARTH.

The subjoined Review is taken from the London Quarterly Journal of Science and the Arts, for which work it was written, and is from the pen of Professor James Renwick, of Columbia College, New-York. It will, perhaps, be thought by some persons, that the subject is too

abstruse for a Journal devoted principally to the promotion of the mechanic arts; but, while the Editor will constantly keep this object in view, he has been careful to reserve a place for "general science." In selecting articles of this description, those only will be chosen, which treat their subjects in a manner, sufficiently popular, to be understood by intelligent, though unlearned readers. Such, in the opinion of the Editor, is the review before us. It is written in a style of peculiar clearness, well calculated to give to the general reader, a correct view of the nature and importance of the operations detailed in Captain Sabine's work. It is believed to contain more information upon the subject of the experiments, which have been instituted to determine the true figure of the earth, by means of the vibration of the pendulum, and thence to obtain a correct standard of lineal measurement, than is elsewhere to be found in the same compass.

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An account of experiments to determine the figure of the Earth, by means of a pendulum, vibrating seconds, in different latitudes, and on various other subjects of philosophical inquiry. By CAPTAIN EDWARD SABINE, F.R.S., &c.

[The following Review of the first part of Captain Sabine's work; namely, of his Experiments on the Figure of the Earth, has been transmitted to us from a correspondent in the United States. We are glad to perceive that the works of British Science, are so quickly, and so justly appreciated, on the other side of the Atlantic.]

[*London Quarterly Journal.*

From the time of the first cultivation of science, the size and figure of the earth, have been objects of inquiry. To an ignorant and superficial observer, it presents the appearance of an extended plane; to the earliest cultivators of astronomy, it showed an evident curvature in the direction of the meridian; and it was not long before a curvature in a transverse direction, was also detected by means of a difference in the apparent time of the occurrence of lunar eclipses, in different places; hence, the earth was justly inferred to be of a figure nearly spherical. Other observations have confirmed the near approach of this inference to the truth; the shape of the section of the shadow in lunar eclipses, is always circular; the appearance of great expanses of water, is manifestly spherical. Ships, in departing from the shore, are hidden by the curvature of the earth, long before distance alone, could render them invisible: and Humboldt, upon the Peak of Teneriffe, observed an angle of 92° between his visible horizon and the zenith. All these, and innumerable other facts, lead to the confirmation of the received opinion, that the earth is, if not an exact sphere, of a shape that differs but little from that regular geometric solid.

Were the earth at rest in space, and had it originally existed in a fluid state, its several particles would, by their mutual attraction, have arranged themselves in a spherical form; had the matter, of

which it is composed, been incompressible and homogeneous, this sphere would have been of equal density throughout; but if its substance had admitted of compression, the outer portion would have been the most rare, and the mass would have increased gradually in density, to the centre.

But the form of the earth, is affected by another circumstance. When a body is made to revolve around a fixed axis, its several particles describe circles, whose planes are perpendicular to, and whose centres are in, the axis. In this way, all the particles, excepting those situated in the axis itself, become affected by a centrifugal force, that, did no other power oppose its action, would cause them to fly off in tangents to the curves in which they revolve: this force, is in each particle, proportioned to the radius of the circle it describes. In solid bodies, the attraction of aggregation is, generally speaking, sufficient to prevent any disintegration, as a consequence of the action of the centrifugal force; and in the larger masses of matter, whether solid or fluid, the attraction of gravitation produces the same effect. Our earth is a body that is in a state of rapid rotatory motion, performing a complete revolution around its axis, in the space of a sidereal day. Each point upon its surface is therefore acted upon by a centrifugal force. This is greatest at the equator, and becomes zero at the poles; and although the attraction of gravitation, is far more than sufficient to render this centrifugal force of no effect, in throwing off any portion of the matter, of which the earth, or its surrounding atmosphere, is composed, it is yet rendered manifest, by a diminution in the intensity of the force of gravity. This diminution of the intensity of gravitation, will affect the rate at which heavy bodies fall to the surface of the earth, and the time of the oscillations of pendulums. It was first observed by Richer, a French astronomer, who visited Cayenne, in 1672, for the purpose of making astronomical observations; he was furnished with a clock that marked mean solar time, in the latitude of Paris; and, to his surprise, he found, that at Cayenne, in lat. 5° N. its rate had become 2′ 28″ per day, too slow. As this was a far greater change than could be accounted for, by any alteration in the length of the pendulum, caused by difference of temperature, no explanation remained, excepting that furnished by the opposition of the centrifugal force, to the attractive power of the earth. The centrifugal force, as has already been stated, is proportionate, at any point of the earth's surface, to the radius of the circle described by that point, in its diurnal revolution, or to the cosine of the latitude: but this is not the measure of the diminution it causes in the intensity of gravitation; for the latter, acts in the direction of a radius of the terrestrial sphere, while the former, is parallel to an equatorial diameter: on account of this obliquity of action, the diminution in the force of gravity, arising from the diurnal rotation of the earth, is every where proportioned, not to the cosine of the latitude simply, but to its square.

The investigations of Newton, and Huygens, into the laws that regulate the action of central forces, furnish us with means, by which, the relation between the whole gravitating force of the earth, and its diminution at the equator, under the action of a centrifugal force,

may be determined: supposing the earth to be a sphere, this ratio is that of 289 to 1; but in consequence of the flattening of the earth at the poles, and its increased diameter at the equator, of which we are about to speak, this relation is changed, and the centrifugal force bears a somewhat higher proportion to that of gravitation. A great part of the surface of the globe, is covered with water, and many of the hypotheses of geologists suppose that the earth was originally in a liquid state. The figure of the earth, and the curvature of its surface, is that which the surface of the great mass of water spontaneously assumes; and hence grew the belief, that the shape of our globe cannot be that of a perfect sphere; for were the solid nucleus of the earth perfectly spherical, the waters of the ocean must have accumulated themselves, by virtue of the centrifugal force, in a zone, on each side of the equator.

In order that a mass of fluid, acted upon by its own gravitation, and the centrifugal force arising from its rotation around an axis, should be at rest, and have no tendency to move towards either its poles or its equator, it is necessary that the pressure of all the columns of fluids, extending from the centre to the surface, should be equal to each other. These several columns, if enclosed in tubes communicating with each other at the centre, would therefore be in equilibrio; but a column beneath the equator, being formed of matter, whose gravity is diminished by the centrifugal force, must be longer than one terminating at the pole, and the lengths of the intermediate columns must vary according to their latitude. The figure that would result from such a state of equilibrium, was investigated by both Newton and Huygens, but upon two different hypotheses. Newton conceived the force of gravity to arise from the mutual attraction of all the particles that compose the earth, acting upon each other with forces inversely proportioned to the squares of their respective distances; he thence inferred that this force was not a constant one, and that if the figure of the earth was due to the attraction of gravitation, the intensity of this force at different points, was affected by the earth's figure. The earth being once flattened by the centrifugal force, this very change of figure, would render the force of gravity at the equator, the least intense: applying this theory to a homogeneous spherical mass, and assuming, most happily, that an ellipsoid, of revolution, would fulfil the conditions of equilibrium, he inferred that the proportion between the polar and equatorial diameters, was as 229 to 230, and the compression $\frac{1}{230}$ part of the greater axis. Huygens, on the other hand, denied that the particles were mutually attractive of each other; and assumed, that each particle tended towards the common centre, with a force inversely, as the square of its distance from that point; by means of this hypothesis, he concluded that the curve, by whose revolution the terrestrial spheriod was generated, was not a conic-section, but a curve of the fourth order, although when the centrifugal force bore but a small proportion to gravity, it would not differ, sensibly, from an ellipsis. He found the proportion, between the greatest and least diameters of this curve, to be as 577 to 578, and a consequent ellipticity of $\frac{1}{578}$.

Different as are these two hypotheses, and their results, there is still one remarkable accordance between them; for by both, the sum of the fractions that express the ellipticity, and the excess of gravity at the pole, over that at the equator, are identical.

The hypothesis of Huygens is now exploded, inasmuch as the mutual attraction of all gravitating bodies, is admitted; but his investigation is not of the less value; for it gives the flattening that would take place, under the received law of attraction, provided the earth were composed of concentric shells, infinitely rare at the surface, and infinitely dense at the centre: and as Newton's investigation gives the compression, in the case of uniform density, we have thus the extreme limits, between which, every possible difference in the ellipticity of the earth, that can arise from a difference in its internal constitution, must be comprised.

The inferences of Newton, were confirmed by Clairaut; who furnished strict demonstrations of two propositions, assumed by that great philosopher. These are, 1st, that the elliptic figure, satisfies the conditions of equilibrium; and 2d, that the centrifugal force varies with the square of the cosine of the latitude. He also demonstrated a theorem, that has since been of much use in determining the shape of the earth, from observations on the intensity of gravity. This important theorem is as follows, viz.: *The sum of the two fractions, one of which represents the ellipticity of the earth, and the other, the ratio of the force of gravity at the poles, to that at the equator, is equal to* 5-2 *of the fraction expressing the ratio of the centrifugal force at the equator, to the force of gravity.*

We are only acquainted with the mere crust of the globe we inhabit; but reasoning from the nature of the substances of which it is composed, we might infer an increase in its density, between the surface and the centre. The same inference may be drawn from the experiments of Cavendish, with the balance of Torsion, and the observations of Maskelyne, on the attraction of the mountain Schehallion: from these different methods, a mean density may be inferred, of not less than four and a half times that of water, while the outer shell has a specific gravity considerably below 3. La Place, too, assuming the density of the surface, to be three times that of water, has inferred a mean density of 4.746. It will, therefore, be evident, that the ellipticity ought to be less than $\frac{1}{230}$; but the mere application of the calculus, does not furnish the measure of its true amount; for we are ignorant of the nature of the substances under investigation, and the circumstances under which they were first united in one mass. Had the earth been originally a fluid, with a compressibility equal to that found to exist in water, by the experiments of Canton, the ellipticity would have been $\frac{1}{360}$; but this hypothesis is probably wide of the truth, and the inferred ellipticity, consequently incorrect.

In order to ascertain the real figure of the earth, it is absolutely necessary to have recourse to experiment and observation. The method that would at first appear most obvious, is that of actually measuring a portion of one of its meridians; should its degrees be found all equal, a truly spherical figure might be inferred; should

they decrease from the equator to the pole, an elongation would be proved; but should the degrees nearest to the pole, be found the longest, no doubt need be entertained that the earth is flattened in the direction of its axis of revolution. With these views, a portion of a meridian, extending from Dunkirk, to the southern frontier of France, was measured by Picard and Cassini. The apparent result of this operation, led to conclusions totally different from those deduced from the theory of gravitation, and the laws of central forces. The southernmost degrees of this arc, appeared to be the longest; and thus ground was afforded for the belief, that the earth was an oblong, instead of an oblate spheroid.*

The measure of Picard and Cassini, being at variance with the received hypothesis, but the instruments, and methods of the age, being insufficient to discover the error, it was proposed, by way of ascertaining the truth in the most unexceptionable manner, to measure a degree under the equator, and another, as near to the pole as was practicable. With this view, Maupertius, was sent to Lapland, and Condamine, to Peru. Their measures confirmed the general theory of Newton, in manifesting the oblateness of the earth. The degree of Maupertius, compared with those, measured in France, gave for the fraction expressing the degree of oblateness, $\frac{1}{178}$; but by a recent measure of the same degree, by Soanburg, an error of more than 200 toises, in excess, has been detected; and the determination of this astronomer, compared with degrees measured in France, reduces the flattening to $\frac{1}{304}$. The French arc, has subsequently been extended into Spain, and as far south, as the island of Formentera. In England, an arc of three degrees, extending from Dunnose, in the Isle of Wight, to Clifton, was measured by General Mudge; and it has since been extended as far as Unst, one of the Shetland Islands. Various other arcs have been measured, at different times; as at the Cape of Good Hope, by La Caile; in Pennsylvania, by Mason and Dixon; in Italy, by Boscovich; in Hungary, by Liesganig; and in India, by Lambton. If many of the contiguous partial arcs, show an elongation, still, all, when compared with others, at a considerable distance, to the north or south, show a flattening towards the poles: but, although this may be considered as fully established, there yet remains very considerable doubt as to the value of the fraction, that expresses the relation between the polar, and equatorial diameters, of the generating ellipsis; the results, obtained by comparing the different measurements with each other, varying so greatly, as scarcely to have narrowed the question within the limits in which it had been reduced by the hypothesis of Newton and Huygens, and the demonstrations of Clairault.

This variation, particularly where recent measures are concerned, is not attributable to a deficiency, either in the observers, the instruments, or the methods of observation and calculation. It appears to be

* The same arc, has since been more correctly measured, by Mechaine and Delambre, towards the end of the last century, by which a different result was obtained; giving the fraction $\frac{1}{303}$ for the flattening at the poles.

occasioned principally, if not entirely, by the deflection which the plumb-line undergoes, from the unequal density of the materials near the surface of the earth, and which affects the celestial determination of the latitude at the extremities of the measured arc; no means are, as yet, known, by which the errors thus occasioned, may be avoided; or their amount ascertained, and allowed for. It is to their influence, that we must ascribe the fact, that by combining together the French and British surveys, whereby an arc, of nearly a fourth of the quadrant of the meridian, is obtained, the ellipticity deduced, is much greater than would appear from a comparison of the separate degrees of this very arc, with those measured near the equator. If a precise determination of the figure of the earth, can ever be hoped for, by the measurement of portions of the meridian, it can only be, by the comparison of arcs of very considerable extent; certainly, of not less than five degrees, accomplished at parts of the meridian, extremely distant from each other.

Other methods, however, exist, that are liable to less uncertainty. The accumulation of matter, in the equatorial regions, modifies the action of the earth upon the moon; insomuch, that the motion of the latter is affected by two irregularities—one, in latitude; and the other, in longitude. The maximum effect of these equations, may be determined by observation; and hence, the extent of the cause may be investigated. The calculation has actually been made, by Bouvard, Burg, and Burkhardt, at the instance of La Place, and gives an ellipticity of $\frac{1}{306}$. This method has a great advantage over actual measurement; for it is independent of irregularities on the surface of the earth, or of inequalities in its internal constitution.

Observations upon the length of the pendulum, beating seconds, in different latitudes, also furnish a method by which the compression may be determined. The length of the seconds' pendulum, may be demonstrated, to be exactly proportioned to the force of gravity, at the place of observation. The comparison of such observations at different latitudes, will afford the data for calculating the lengths of the pendulum at the pole, and beneath the equator: these, being respectively proportioned to the gravitating forces, at these places, give the numerator and denominator of a fraction, that subtracted from $\frac{5}{2}$ of $\frac{1}{289}$, furnishes an expression for the oblateness of the generating ellipse, in conformity with the theorem of Clairaut. This mode of determining the figure of the earth, is better, for several reasons, than that of ascertaining the same fact, from the measure of degrees; whether distant, or contiguous.

It has been shown, by the investigations of La Place, that the term of the formula, in which error may arise from the causes of anomaly, has a coefficient, that is, five times as great, when the ellipticity is inferred from degrees of the meridian, as it is, when it is determined from the lengths of the pendulum in different latitudes. The mode of ascertaining the length of the pendulum vibrating seconds, has been of late years so much improved, as to have become a very simple experiment, that may be well performed by a single compe-

tent observer; while the measure of a degree of the meridian, is a laborious, tedious, and expensive process.

The work, whose title appears at the head of the present article, is, for the most part, occupied with an account of experiments made to determine the length of the pendulum, vibrating seconds, in different latitudes, and in both hemispheres. They were performed during two voyages made in public vessels, and in the employ of government: in the first, the author visited, and performed experiments at Sierra Leone, St. Thomas', the islands of Ascension, Bahia, Maranham, Trinidad, Jamaica, and at New York; during the second, he landed, and experimented at Hammerfest, Fairhaven in Spitzbergen, on the coast of Greenland, and at Drontheim.

The method principally relied upon by our author, and employed by him at all his stations, is the same which was previously used by Captain Kater, at the several stations of the British Trigonometrical Survey, as detailed by him, in the *Philosophical Transactions*, for 1819. The fundamental experiment of this method, consists in suspending a pendulum alternately, from two knife edges; one, in the usual position of the centre of suspension; the other, near the lens of the pendulum: the vibrations of the pendulum, when suspended from these two distant points, are rendered isochronous, by a change in the position of a small weight, that slides along the pendulum rod; the point near the lens, is thus rendered the centre of oscillation, in consequence of a property of the pendulum, discovered by Huygens; who demonstrated, that the centres of oscillation, and suspension, were convertible points. The distance between the knife edges, may be measured with great accuracy, by means of microscropes attached to accurate scales; giving thus the true length of the experimental pendulum: the number of oscillations it performs in any given time, may be ascertained by comparison with the pendulum of a well-regulated clock; and hence, the length of the pendulum, vibrating seconds, at the place of experiment, may be determined, by applying the well known proposition, that the lengths of pendulums are inversely, as the squares of the numbers of their respective vibrations, in equal times. After the length of the seconds' pendulum, has been thus determined, in any one place, by experiments sufficiently multiplied to ensure against any probable error, another pendulum, of similar shape to the first, with the exception of its having no moveable weight, and but one knife edge, which is situated at the usual centre of suspension, is employed. This pendulum may be hung up in front of the clock, with which the original experiment was made; or of some other whose rate is known, and which is placed in the same apartment: its rate of oscillation, may be thus known, and its length calculated, upon the same principle as that which we have stated, as the mode in which the length of the seconds' pendulum, was originally determined. The length of this last mentioned experimental pendulum, being thus ascertained, and with an accuracy equal to that of the fundamental experiment, it may be carried from station to station; the number of its vibrations, in a given time, as shown at each station, by comparison with an astronomical clock, will furnish data,

whence the length of the pendulum, vibrating seconds at that place, may be calculated. This method is, undoubtedly, the best that has hitherto been proposed; and we are not prepared to say that it is susceptible of any material improvement, in the theoretic part. The manner of construction, or even of using the instrument, may perhaps undergo change; (the latter, has undergone a very important change, since its first employment by Captain Kater, in the improved method suggested by Captain Sabine, and adopted by him, of observing the coincidences,) but we cannot fairly anticipate, that any principle more beautiful, or more readily reduced to practice, is likely to be discovered.

[TO BE CONTINUED.]

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir—Should you think the subjoined extract of a letter, worthy of insertion in your Journal, you are at liberty to publish it. Perhaps you are in possession of further information on the subject, or may think it worth while to obtain it from the patentee.

Yours, &c. W.

Extract of a letter from Baltimore, dated Feb. 20th, 1826.

"Since my return I have made further inquiries in relation to the 'Baltimore patent Roofing;' the inventor, a member of our academy, possessing a considerable stock of knowledge, is a manufacturer of oil floor cloth; he informed me, that his attention was turned towards the subject, by the following circumstances:—About nine years ago, he covered part of the roof of his 'paint grinding establishment' with such small pieces of the oil cloth, as are cut off in fitting it to apartments, and that several years afterwards, he found it was tighter than any other part of the roof. He thence concluded, that, as the kind intended for flooring, had lasted so well, he might, by the application of a stouter canvass, and of a composition, better calculated to resist the effect of the action of the weather, form a roofing of a very durable nature. He now believes he has succeeded. There are many advantages connected with it; among others, are the quickness with which it may be put on, the little liability to leaking, from being in one piece, for an ordinary house, and the flatness. It should, however, have an inclination of at least six degrees, and should be laid on boards close together; it is also necessary, to give it, annually, a coat of *paint-oil*; 2 or 3 gallons is sufficient, for a house of a common size. Mr. Denison says, the only fear he has, is, that some careless persons, who may use it, may not attend to the directions, and if it should not last, that they would impute to the article, what they should charge to their own neglect.

The proprietor of the Warren Factory, 14 miles from Baltimore, has lately roofed a building, 70 feet long, with it. Part of the New City Hotel building here, is to be covered in like manner."

The above extract reminds the Editor of a fact, which came to his knowledge many years since. A store keeper, living in Second, near

Arch street, purchased from an importer of English floor cloth, a yard or two of that article, with which he proposed to stop a leak in the roof of his house, which he had repeatedly attempted to repair, without success. Four or five years after the application of the floor-cloth, it continued to answer the intended purpose, not a drop of water having found its way through.

The Editor has taken means to obtain further information on the subject of the patent roofing.

The following queries and suggestions, are extracted from letters recently received by a gentleman of this city, from his correspondent, an individual of great intelligence, practically engaged in rural affairs, and who has introduced some valuable improvements in the economic arts.

On preserving Fruit Trees from frost.

"There is an article in the last 'American Farmer,' on the subject of preserving fruit trees from frost. It is there asserted, that if a fruit tree be *enveloped* with straw, or hempen ropes, and the lower ends of the rope be put into a tub of water, that the trees will not be injured by the frost. I should like to ascertain the *truth* of the experiment, before I reasoned on it. I wish you could get the editor of the Franklin Journal to interest himself in this thing; it might produce a discussion of the subject, which might be very beneficial, as it is one of great importance. My own trees, should they remain untouched by late frosts, will, this year, produce me upwards of two thousand dollars, although they are yet young.

"I am preparing to make small *bon-fires*, as I think that smoke will be an effectual preventive, and am determined to try it. It however will be very troublesome, to attend as many little mounds of burning tan, as three thousand trees will require. If I am unable to test it upon the whole, I shall, if possible, protect my peach trees."

"Inquire whether pure oxygen gas escapes from burning saltpetre; and if so, what effect would the disengagement of as much as would proceed from the burning of twenty pounds, have upon an area of ten acres?"

"Would the gas from the burning of saltpetre and sulphur, be destructive to the insect tribe, or only dislodge them?"

Remarks by the Editor.—The mode of preserving trees from frost, above suggested, has been frequently tried, and some have declared it to be effectual. Many vague notions, respecting the conducting power of the rope, in relation either to heat or to electricity, have been brought forward to account for the supposed fact; but certainly by those who have little, or no knowledge of the laws which govern these agents, as the rope would, in either case, be a miserable conductor; and even were it a good one, it is not perceived what aid this would give towards explaining the imagined phenomenon. It would require numerous, varied, and well authenticated experiments, to shake the con-

viction of the editor, that the whole is one of those errors, which having been once disseminated, it is very difficult to eradicate.

The efficacy of the proposed bon-fires, is much less problemetical; a slight difference in the exposure of a tree, determines its fate, on a frosty night; and of course, a slight elevation of temperature in its atmosphere, would frequently avert the danger; fires of tan, of turf, or of any smouldering combustible, made to windward, would sometimes answer the purpose; not however from the smoke, but from the heated air, which would accompany it.

With respect to the query on burning saltpetre, we, in the first place remark, that saltpetre will not burn; that it belongs to the class of bodies, denominated incombustible. It contains, it is true, a large quantity of oxygen, which it readily imparts to heated combustibles with which it is in contact: thus, if we throw a portion on burning coals, the combustion will be brilliant and rapid, because the saltpetre supplies the coal with oxygen, more abundantly, than it would obtain it from the air; the product of the combustion, however, will not be altered; carbonic acid, or fixed air, being disengaged, in either case. When oxygen is obtained from saltpetre, the material must be kept from contact with the fuel, by being placed in an earthen or iron vessel; when the salt will be decomposed, the heat disengaging the oxygen, in the gaseous state. Supposing all this to be done, the disengaged gas, would still produce no other effect than that of heated atmospheric air.

Saltpetre and sulphur, burnt together, would be less effectual in destroying insects, than sulphur burnt alone, or mixed up with sawdust, tan, &c. Sulphur, burnt without saltpetre, is converted into a gas, (sulphurous acid,) which is destructive of animal life, and will kill the insect tribe, if they are completely subjected to its action, as when applied below one of their nests; but when much diluted with atmospheric air, its effects are but partial.

Sulphur, when burnt in contact with saltpetre, receives from it, a full supply of oxygen, and is then converted into sulphuric acid, (oil of vitriol,) which is a dense liquid, not at all calculated to promote the intended effect.

On Springs, (from the same.)

"It has been asserted by *all* philosophers, from Halley, down to the writers of the present day, that water cannot rise above the source whence it originates. This opinion is certainly erroneous, although it receives support from a number of philosophical experiments, which are conclusive so far as they go; these, however, serve only to manifest the effects of gravity; but water may certainly be propelled by other natural causes, besides that of gravitation. We know that certain gases are disengaged in the interior of the earth, either by the decomposition of water, or of other substances, from various causes, into which it is not necessary now to inquire."

"If in boring for water, there be a stream running horizontally or obliquely, in the line of the bored aperture, the instruments will of

course intersect it: if the reservoir which supplies this stream, be situated higher than the spring at the intersected part, the water will rise to the level of the reservoir, in tubes which may be inserted: if, however, the stream flow in a horizontal line from its source, and is consequently on the same level with it, the water instead of ascending in the tubes, will follow the borers in their descent, in accordance with the received theory. But if in boring deeper, we encounter a fissure, through which confined gases are acting with great elastic force, this stream of water may be thereby forced to rise through the bore in spite of its gravitating power. In this way, in many cases, particularly in boring through strata of lime-stone, or chalk, water may ascend to the surface, although the reservoir by which it is supplied, may be 40, 50, or even 100 feet below."

"It may also sometimes happen, that after passing the stream, in the manner before supposed, the borers may proceed until they perforate a stratum of minerals, from which a large quantity of gas will be immediately extricated, and by which the water may, at first, be raised to the surface, with considerable force, yet its flow may not be permanent. This may arise from the disruption of the parts of the mineral upon which the water operates, thus opening for itself a larger space in which it may be deposited, amd from which it may escape, by having a larger surface through which to percolate. The action of the gas, by which it was at first forced upwards, will thus be counteracted, and the flow at the surface will of course cease."

"Many cases might be cited, to prove that the received theory is incorrect, some of which have been too recently published, to admit of the supposition that the inquisitive are ignorant of them. On the top of St. Helena, there is a fresh water spring. On the Azores also, there are many springs, and, from their situation, and their volcanic origin, these islands cannot obtain their water from fountains of greater elevation. There must, therefore, be some internal commotion of the solids and fluids, which causes the water to rise to the surface. How small a portion of the power, which at first heaved up from the bottom of the ocean, the immense masses of which these islands consist, would suffice to force the water to rise through their numerous fissures, to the surface of the ground! It is admitted that gases and elastic vapours may have been disengaged in such quantities as to raise mountains, and yet the position is disputed, that a lesser portion of the same force, may cause a small stream of water to ascend to a level higher than its source.

"The philosophy of the schools is so prevalent, and all those imbued with its doctrines, subscribe so unhesitatingly to its dictates, that but one opinion can be elicited from them. I fear, therefore, that but little attention will be bestowed on the above remarks. I confess, I am of opinion, that water may be made to flow above the surface in every situation; in some places, we might have to bore to a very great depth, before the proper stratum would be reached, but this does not effect the correctness of the assumption. I am assured that in boring, gases are more frequently met with, than is generally supposed; and that their agency is sufficient to produce the effects which I have ascribed to them."

Query.—"Would it not be well for Dr. Jones to give, in each number of his Journal, a few lines of explanatory terms, as those persons for whom it is principally intended, although sensible and clear minded people, are generally unacquainted with the nomenclature of science, and have neither the time nor the opportunity to search elsewhere for explanations? In reading the article by B. Bevan, to an ingenious mechanic, he stopped me several times, to ask the meaning of such words as *outcrop*, &c. Perhaps it might not be requisite to explain more than dozen words in a whole number; but without this explanation, many articles may not be understood, which, with it, might prove both interesting, and useful."

Remarks.—Although the Editor believes the received theory on the subject of springs, to be true, and therefore, cannot subscribe to the opinion, that water may be made to rise to the surface, in every situation, he willingly assigns a place to the foregoing observations.—Under the circumstances supposed, a lighter, cannot force up a heavier fluid; the gas, of whatever kind it might be, would rise through the shaft, and allow the water to descend; if rapidly disengaged, it would blow up a portion of the water, but would not raise it alone. Under peculiar circumstances, water may ascend, and springs may exist, in situations above the level of any reservoir; it may undoubtedly be evaporated by subterraneous fires; this vapour, may be condensed in elevated situations, and then flow out in the form of a spring; such, in other places, may be the peculiar nature of the soil, that water may be raised to some height, by capillary attraction and we could imagine that a spring might thus be supplied. But these would only form exceptions to a general law, from the existence of circumstances, of rare occurrence.

The suggestion respecting terms of science, merits, and shall receive, attention. To render science, subservient to the arts, is a main object of this work; the aims of the Editor are high, but the novelty of the undertaking, and the many arrangements which he has had to make, have, in some measure, prevented the full accomplishment of his views. In the attempt, he has been gratified by the approbation of the intelligent; and he is determined to increase his claims to this valued reward of his labours.

COMPOUNDS OF METALS.

FROM NICHOLSON'S OPERATIVE MECHANIC.

(*Continued from page* 124.)

Gun Metal, No. 1.—16 parts of good brass,
2 parts of zinc, and
1 part of block-tin.

No. 2.—9 parts of copper, and
1 part of tin.

The above compounds are those used in the manufacture of small and great brass guns, swivels, &c.

Blanched Copper.—16 parts of copper, and
1 part of neutral arsenical salt,
fused together, under a flux compound of calcined borax, charcoal dust, and fine powder glass.

Specula of Telescopes.—7 parts of copper, and when fused, add
3 parts of zinc, and
4 parts of tin.

These metals will combine, and form a beautiful alloy of great lustre, and of a light yellow colour, fitted to be made into specula, for telescopes. Mr. Mudge used only copper and grain tin, in the proportion of two pounds, to fourteen and a half ounces.

Kerstitien's Metal, for tinning.

To 1 part of malleable iron, at a white heat, add
$\frac{1}{4}$ of a part of regulus of antimony, and
24 parts of the purest Molucca tin.

This alloy polishes without the blue tint, and is free from lead or arsenic.

Metal, for Flute-key Valves.

4 parts of lead, and
2 parts of antimony,
fused in a crucible, and cast into a bar, form an alloy of considerable hardness and lustre. It is used by flute manufacturers, (when turned into small buttons in the lathe,) for making valves to stop the key-holes of flutes.

Printers' Types.—5 parts of lead, and
1 part of antimony.

The antimony must be thrown into the crucible, when the lead is in a state of fusion. The antimony gives a hardness to the lead, without which, the type would speedily be rendered useless in a printing press. Different proportions of lead, copper, brass, and antimony, frequently constitute this metal. Every artist has his own proportions, so that the same composition cannot be obtained from different founderies; each boasts of the superiority of his own mixture.

Small Types and Stereotype Plates, No. 1.

9 parts of lead, and when melted, add
2 parts of antimony, and
1 part of bismuth.

This alloy expands as it cools, and is, therefore, well suited for the formation of small printing types, (particularly when many are cast together, to form stereotype plates,) as the whole of the mould is accurately filled with the alloy; consequently there can be no blemish in the letters.

No. 2.—8 parts lead,
2 parts antimony, and
$\frac{1}{4}$ part tin.

For the manufacture of stereotype plates, plaster of Paris, of the consistence of batter-pudding before baking, is poured over the letter-press page, and worked into the interstices of the types with a brush. It is then collected from the sides by a slip of iron or wood, so as to lie smooth and compact. In about two minutes the whole mass is hardened into a solid cake, this cake, which is to serve as the matrix of the stereotype plate, is now put upon a rack in an oven, where it undergoes considerable heat, so as to drive off superfluous moisture. When ready for use, these moulds, according to their size, are placed in flat cast-iron pots, and are covered over with another piece of cast-iron, perforated at each end, to admit the metallic composition intended for the preparation of the stereotype plates. The flat cast-iron pots, are now fastened in a crane, which carries them steadily to the metallic bath, or melting-pot, where they are immersed, and kept for a considerable time, until all the pores and crevices of the mould are completely and accurately filled. When this has taken place, the pots are elevated from the bath by working the crane, and are placed over a water-trough to cool gradually. When cold, the whole is turned out of the pots, and the plaster being separated by hammering and washing, the plates are ready for use, having received the most exact and perfect impression.

Metallic Casts from Engravings on Copper.

A most important discovery has lately been made, which promises to be of considerable utility in the fine arts: some very beautiful specimens of metallic plates, of a peculiar composition, have lately appeared, under the name of "cast engravings." This invention consists in taking moulds from every kind of engravings; with line, mezzitinto, or aquatinta; and pouring on these moulds, an alloy, in a state of fusion, capable of taking the finest impressions. The obvious utility of this invention, as applicable to engravings which meet with a ready sale, and of which great numbers are required, will be incalculable; as it will wholly prevent the expense of retracing, which forms so prominent a charge, in all works of an extended sale. No sooner is one cast worn out, than another may be immediately procured from the original plate, so that every impression will be a proof. Thus the works of our most celebrated artists, may be handed down, *ad infinitum*, for the improvement and delight of future ages, and will afford, at the same time, the greatest satisfaction to every lover of the fine arts.

Common Pewter.—56 parts of tin,
8 parts of lead,
3 parts of copper, and
1 part of zinc.

The copper must be fused, before the other ingredients are added. This combination of metals, will form an alloy of great durability, and tenacity; also, of considerable lustre.

Best Pewter.—100 parts of tin, and
17 parts of regulus of antimony.

Hard Pewter.—12 parts of tin,
1 part of regulus of antimony, and
¼ part of copper.

Common Solder.—2 parts of lead, and
1 part of tin.

The lead must be melted, before the tin is added. This alloy, when heated by a hot iron, and applied to the tinned iron, with powdered rosin, acts as a cement, or solder; it is also used to join lead pipes, &c.

Soft Solder.—2 parts of tin, and
1 part of lead.

Solder for Steel Joints.—19 parts of fine silver,
1 part of copper, and
2 parts of brass,

melted together under a coat of charcoal dust. This solder possesses several advantages over the usual zinc solder, or brass, when employed in soldering cast steel, &c. as it fuses with less heat, and its whiteness has a better appearance than brass.

Silver Solder for Jewellers.

19 parts of fine silver,
1 part of copper, and
10 parts of brass.

Silver Solder for Plating.

1 part of brass, and
2 parts of pure silver.

Gold solder.—6 parts of pure gold,
1 part of pure silver, and
2 parts of copper.

Brass solder for Iron.—Thin plates of brass are to be melted between the pieces that are to be joined. If the work be very fine, as when two leaves of a broken saw, are to be brazed together, cover it with pulverized borax, moistened with water, that it may incorporate with the brass powder, which is added to it: the piece must be then exposed to the fire, without touching the coals, and heated till the brass is seen to run.

Bronze.—7 parts of pure copper,
3 parts of zinc, and
2 parts of tin.

The copper must be fused, before the other ingredients are added. These metals, when combined, form the bronze so much used, both in ancient and modern times, in the formation of busts, medals, and statues.

Composition of ancient Statues.

According to Pliny, the metal used by the Romans, for their statues, and for the plates on which they engraved inscriptions, was composed in the following manner. They first melted a quantity of copper, into which, they put ⅓ of its weight of old copper, which had

been long in use; to every 100lbs. weight of this mixture, they added 12½lbs. of an alloy composed of equal parts of lead and tin.

Mock Platinum.—Melt together,
8 parts of brass, and
5 parts of zinc.

Useful alloy of Gold with Platinum.
15 parts of pure gold, and
1 part of platinum.

The platinum must be added, when the gold is perfectly melted. The two metals will combine intimately, forming an alloy, rather whiter than pure gold, but remarkably ductile, and elastic; it is also, less perishable than pure gold, or jewellers' gold; but more readily fusible than that metal.

These excellent qualities, must render this alloy an object of great interest to workers in metals. For *springs*, where steel cannot be used, it will prove exceedingly advantageous.

It is a curious circumstance, that the alloy of gold and platinum, is soluble in nitric acid, which does not act on either of the metals in a separate state. It is remarkable, too, that the alloy has very nearly the colour of platinum, even when composed of eleven parts of gold, to one, of the former metal.

Ring Gold.—6 dwts. 12 grs. Spanish copper,
3 dwts. 16 grs. fine silver, and
1 oz. 5 dwts. gold coin.

Gold, 35s. to 40s. sterling, per ounce.
8 dwts. 8 grs. Spanish copper,
10 dwts. fine silver, and
1 oz. gold coin.

Manheim Gold, or Similor.
3½ oz. of copper,
1⅛ oz. of brass, and
15 grs. pure tin.

Metal to gild on.—4 parts of copper,
1 part of Bristol old brass, and
14 oz. of tin, to every pound of copper.

For common Jewellery.—3 parts of copper,
1 part of Bristol old brass, and
4 oz. of tin, to every pound of copper.

If this alloy is for fine polishing, the tin may be omitted, and a mixture of lead, and antimony, substituted. Paler polishing metal is made by reducing the copper to two, or to one part.

Yellow Dipping Metal.—No. 1.
2 parts of Cheadle brass,
1 part of copper, with a little
Bristol old brass, and
¼ oz. of tin, to every pound of copper.

This alloy is almost of the colour of gold coin. Cheadle brass is the darkest, and gives the metal a greenish hue. Old Bristol brass, is pale, and yellow.

No. 2.—16 parts of copper, and
5 parts of zinc.

The copper should be tough cake, and not tile.

When antimony is used instead of tin, it should be in smaller quantity, or the metal will be brittle.

Imitation of Silver.—$\frac{3}{4}$ oz. of tin, and
1 lb. of copper,
will make a pale bell metal, which will roll, and ring, very nearly equal to sterling silver.

On a new mode of Embossing Designs on Wood. By Mr. JOHN STRAKER.

Raised figures on wood, such as are employed in picture-frames, and other articles of ornamental cabinet-work, are produced by means of carving, or by casting the pattern in Paris-plaster or other composition, and cementing, or otherwise fixing it on the surface of the wood. The former mode is expensive; the latter is inapplicable on many occasions.

The invention of Mr. Straker may be used either by itself, or in aid of carving; and depends on the fact, that if a depression be made by a blunt instrument on the surface of wood, such depressed part will again rise to its original level by subsequent immersion in water.

The wood to be ornamented, having first been worked out to its proposed shape, is in a state to receive the drawing of the pattern; this being put in, a steel-punch, or die, properly formed, is to be applied successively to all those parts of the pattern intended to be in relief, and at the same time is to be driven very cautiously, without breaking the grain of the wood, till the depth of the depression is equal to the subsequent prominence of the figures. The ground is then to be reduced, by planing or filing, to the level of the depressed part; after which, the piece of wood being placed in water, either hot or cold, the parts previously depressed will rise to their former height, and will thus form an embossed pattern, which may be finished by the usual operations of carving.

Remarks by the Editor.

The above is from the Transactions of the Society, in London, for the Encouragement of Arts, Manufactures, and Commerce; who voted a silver medal, and ten guineas, to Mr. Straker, for his invention. The Editor, when a boy, possessed an old book, in which the above process was detailed as fully as in the article before us. This book must have been published at least eighty years ago; the kinds of wood, most suitable for the process, were mentioned, and some arti-

cles particularized, to which it might be applied. So much for originality. With regard to its utility, we observe, that the texture of the wood will be greatly weakened; for ornamental gilding, this is unimportant; but when the projecting parts are to be subjected to any degree of force, as in a walking stick, they would be readily broken, as they have been already bruised in the punching down.

Extract of a Letter, on Tanning, from JOHN BURRIDGE, *to the Editor of the London Journal of Arts.*

"SIR—History and experience prove, that men are frequently more indebted to accident than design, for many of the most useful discoveries and improvements; which are, moreover, often accomplished by the simplest means—the compass, for instance.

"I have discovered the means of ascertaining the relative degrees of strength in oak bark liquors; I have also discovered that the simple and regular application of oak-bark liquors, &c. to hides, will effectually tan sole leather in three or four months, (according to their thicknesses,) provided you commence at three degrees, and gradually increase the strength of the liquor, thrice a week, up to fifteen or twenty degrees, taking care not to apply strong liquors, till the leather is nearly tanned.

"There can be no theory prescribed as to the exact time when the hides may be forced with advantage; practice only can master in this nice point; the simple instrument I use, is an hydrometer, which I have surnamed a BARKOMETER; without which, I should be more in the dark, than brewers without saccharometers or thermometers.

"I have also found means, by the constant use of pumps, to extract all the virtue from oak-bark in ten days, which generally lies in common tan-yards two or three months. My hydrometer proves I throw no tannin away.

"The execution of this process, with daily care, produces additional weight in leather over the standard. Tanners generally require twelve months to tan hides, that may by my system be done in three months, with perfect ease. Common tanners are satisfied if a hide of eighty pounds, when raw, yield forty pounds, when tanned. Whereas, my process will produce forty-eight pounds of leather from similar hides, which is actually one-fifth more leather in a quarter of the usual time. Is this not a plain proof, that hides lay rotting, rather than tanning, after four months? because weight is the criterion of the quality of leather, and the least weight is the fruit of the longest time.

"Many tanners immerse crop hides in bark, for two or three months, during which single stage, I tan the stoutest hides in the kingdom, without more than the usual quantity of bark, because it is generally acknowledged, that four or five pounds of oak-bark, (according to its quality,) will tan one pound of leather."

TANNING LEATHER IN COLD WEATHER.

Have an iron kettle, or boiler, for the purpose of containing water, with a wooden lid or cover; a wooden penstock let into the boiler through the lid or cover, and extending upwards; in one side of the penstock, towards the upper end, is a hole made by an augur, into which enters a common conductor of wood or other materials. The other end of which conductor, passes over the tan vats—the steam arising from the boiler, which is fixed in an arch, ascends the penstock, and from thence passes into the conductor over the vats; one or more wooden conductors to each vat, to be let into the main conductor, and penetrate downward into the vat, which is open at the lower end, will enable persons to tan leather, in cold climates, in the winter season as well as in summer.

EXTRACTS FROM BARK.

That which is designed for the use of tanners, is found to be most highly improved, by adding to every hundred weight of the ground bark, eight pounds of red berry, which grows upon sumack; the advantages therefrom are hardly conceivable, as in the first place it opens the nature of the bark, and causes a much quicker precipitation of the light woody matter, when settling for evaporation. It also holds in a complete dissolved state, every particle of resinous matter contained therein, and supplies the great loss of vegetable acid, so necessary in tanning, and which evidently escapes during the evaporation. The good effects of this addition in regard to tanning, is quickly to be observed from its immediate action on the leather, to which it imparts a fine colour, and fills it in the completest manner.

PREPARING QUILLS.

M. Scholz, of Vienna, has discovered a new process for rendering quills more firm and durable than those of Hamburg. The following are the means employed:—He suspends, in a copper, a certain number of quills, and fills it with water, so as just to touch their nibs. He then closes the copper, so as to render it steam tight; here the quills experience considerable heat and moisture from the steam, by which the fat they contain is melted out. After about four hours' treatment in this manner, they attain the proper degree of softness and transparency. The next day cut the nibs, and draw out the pith, then rub them with a piece of cloth, and also expose them to a moderate heat. The following day they will have acquired the hardness of bone without being brittle, and will be as transparent as glass.

IMPROVEMENT IN THE LIME KILN.

This kiln is made of either earth, brick, or stone, and formed in the following described manner:—

One end of said kiln is built of a square form, having four sides of about eight feet wide each, and ten feet in height.

At the bottom of said square part are three furnaces, or arches, with divisions between them, similar to those in the arches of a brick kiln; these arches extend in depth the same as that of the square part before mentioned, the part over the arches is then filled up, and made level to form the floor of said square part; in the centre of one of the four sides of said square part, there is a door, either at the height of the floor, or higher up.

From one, two, or all the four sides of said square parts, projects an arch, or vault, of a semi-circular form, and about six feet in height: said arch, or vault, extends out about 26 feet, and is formed bevelling towards the extreme end.

At the bottom of the end of said vault there are three furnaces, or arches, in every respect similar to the arches in the square part before described: over each of said arches, at the height of the level floor there are three openings for the purpose of introducing the wood to supply the fire at the back part of the arch or vault.

The lime is taken in from the door in the square part; and laid on the floor of the arch or vault, which is on a level with the bottom of the furnaces or arches before mentioned, the lime-stone is so placed as to form a continuation of the arches at the ends of the kiln. The upper part of the vault or arch is then filled in a compact manner, leaving a vacuum or space between the wall of the narrow end of the vault, and the lime-stone; which vacuum contains the fire that is made on the level part over the under arches.

When the lime-stone is all stowed, the mouth or opening in the widest end of the vault or vaults is then bricked up with loose bricks, the arches filled with wood, and fire set to it, and let burn until the lime-stone is turned to lime. [*London Journal.*

TO CONVERT IRON INTO STEEL.

It is well known to all persons conversant with the art of converting iron into steel, that the pulverized charcoal or carbon, together with whatever other substance they may mix with it, if any, is laid into the furnace in layers, between each layer or strata of iron. 1st. *To make one side of common flat bars of iron into steel, but half through each bar.* Let there be first, a layer of carbon in the common way; then a layer of bars of iron; then a layer of clay, or mixture of clay, that will not melt with the necessary heat to be applied, or any other substance not containing carbon sufficient to convert iron into steel, and that has no tendency to damage the purity of iron. The next layer of iron to be laid upon this clay or other substance, and then again

carbon, and so through the batch alternately, a layer of carbon, and a layer of other substance, between the layers of iron. Being thus laid, and heated a sufficient length of time, and to a proper degree of heat, to convert the bars of iron thoroughly into steel, when laid in the common way, will of course leave these bars half iron.

If it be wished, to make the bars more than half steel, it will be seen at once, that it must be kept hot a suitable time longer; and if less, then half a suitable time shorter. If one edge of flat bars are to be converted to steel, the same principle is to be followed, by setting the bars edgewise in the furnace, and letting the carbon come in contact with the iron, on both sides of the bar; so far as it is wished, it may be converted to steel, applying the clay or other substance to the part to be left, iron; and in whatever shape the iron may be it is immaterial, so that the carbon come in contact with the part to be made into steel, and not elsewhere.

This operation may also be performed without any clay, or any other substance being applied to the parts to be left, iron. The application of clay, &c. is much preferable, as by it there is a more complete command over the parts not to be converted into steel.

METEORIC IRON.

M. Humboldt presented to the Royal Academy of Sciences, at Paris, a fragment of a mass of meteoric iron, which was found in Colombia, at a short distance from Santa Fé de Bogota, near the summit of a mountain. The entire mass weighed 3300 pounds, and required great labour to remove it to the forge of a smith, who bought it for about five pounds, and who began by smelting a part of it, with the intention of employing it for the uses of his trade. Having, however, found it too brittle for his purpose, he gave up the idea of working it, and even concealed the remainder of it, through a fear lest his credit should be injured if it were known he employed such an inferior article. Fortunately, an eminent naturalist, M. Humboldt's correspondent, having accidentally learnt the secret, obtained the mass of iron, and analysed a part of it. The result of this analysis, by proving the existence of a certain quantity of nickel, mingled with the ore, has put the aërial origin of this mass, beyond a doubt. The aërolite of which M. Humboldt has presented a fragment to the Academy, is one of the most curious, mentioned in the history of *science*.

A Process to render Cloth, and Silk, water-proof. By M. COLLET.

The cloth, or silk, must be spread upon a wooden frame, and immersed, or soaked, with the following mixture: linseed oil, one pound, white lead, one ounce and a half; umber, one ounce, and a clove of garlic. The whole of these ingredients must boil for twelve hours on a small

fire; and when the composition is perfectly fit for use, the surface will put on the appearance of skin.

The cloth, after having been immersed in, or washed, with this composition, is to be hung up to dry, and when that is effected, to be rubbed with pumice stone, to render it smooth. It is then to be coated with another thick fluid, composed of linseed oil, one pound; vitrious oxide of lead, one ounce; sulphate of zinc, four drachms; and white lead, calcined till it has changed yellow, four ounces. These must be previously boiled together in an iron pot, until the material have the consistence of paste; the composition is then to be spread equally over the right side of the cloth; the material is then dried upon the fabric in a chamber, heated to forty or fifty degrees; it is necessary to repeat the operation twice for silk, and the result will be the production of an oil skin cloth, which will be water-proof, and not rub nor wash off.

LOCOMOTIVE CARRIAGES.

A new line of railway has just been completed, leading from the colleries, in the neighbourhood of Darlington, to Stockton upon Tees, in the county of Durham, (formed under the direction of Mr. Stevenson, the engineer, of Newcastle.) The wagons are drawn upon plain rails, with curved tops, (Birkinshaws, see vol. ii.) by locomotive steam engines. The construction of these engines, is not different in principle, from those employed upon the Hetton line of railway, near Sunderland; but they exert their power with better effect, and move faster.

The medium speed of the engines and carriages, upon the level parts of the new line, is about six miles per hour; while the speed upon the level of the Hetton line, seldom exceeds three miles and a half, per hour. This improvement is to be attributed to the increased size of the boiler, and to the employment of larger running wheels.

The weight of the locomotive engine, is about seven tons; having a cylindrical boiler, ten feet long, and four feet diameter, coated with wood, to prevent the radiation of heat, and placed in a horizontal position, with the fire inside the cylinder, and the flue two feet diameter, leading straight through the boiler, to the chimney. There are two working pistons moving perpendicularly, in cylinders of nine and a half inches, diameter; which cylinders are principally immersed in the boiler, and the pistons are packed with hemp.

The steam acts at a pressure of thirty pounds, upon every square inch of the boiler; and the safety valve, is loaded to the extent of fifty pounds. The induction and eduction valves of both cylinders, are worked by rods connected to excentrics below, and the alternating power of the pistons, is communicated by parallel motions, and sweep rods on each side, to cranks upon the spokes of the running wheels; the direction of these, cranks upon the fore and hind wheels, being at a quarter of a circle removed, in order to overcome the dead points of the strokes of the pistons, and consequently the range of the cranks

are two feet. The running wheels being four feet diameter, with flanges on their edges.

The water is supplied to the boiler, by pipes leading from a cistern carried in a cart, and attached behind the engine; the same cart also carries the coals for feeding the furnace, which consumes about three quarters of a ton, in going a distance of fifty miles.

Certain parts of the line of road, rise half an inch in a yard; this the power of the engine overcomes readily, with twenty carriages attached to it, each containing about two tons weight, and proceeds as above said, upon an average, at the rate of six miles per hour. On the first day of opening the rail-way, a train of thirty loaded wagons, and a carriage with passengers, was drawn along some part of the line, at the rate of fifteen miles per hour; but this was doubtless a mere experiment; the ordinary speed, is not likely to exceed six miles, as above stated: but this speed, and the employment of a plain rail, is certainly a considerable improvement upon the locomotive carriages, near Leeds, which travel upon a rack or cogged rail, and not faster than two and a half, or three miles, per hour.

New mode of preparing Paper, for the use of Draughtsmen, &c. By Mr. Couder.

Reduce to a powder, and dissolve quickly in a glazed earthen vessel, containing cold water, some gum adragant, having been well worked with a wooden spatula, to free it from lumps. There must be a sufficient quantity of water, to give to this diluted gum, the consistence of a jelly. Paper, and some sorts of stuffs, upon which, if this composition be smoothly applied, with a pencil, or a brush, and dried before a gentle fire, will receive either water or oil colours; in using water colours, they must be mixed with a solution of the above gum. This cloth or paper, so prepared, will take any colour except ink. When it is intended to retouch any particular part of the drawing, it should be washed with a sponge, or clean linen, or a pencil, (containing some of the above-mentioned liquid;) if the part is only small, it will then rise quickly, and appear as if repainted.

A Composition to render Wood fire-proof. By Dr. Fuchs.

Dr. Fuchs, member of the Academy of Science, at Munich, is said to have discovered a composition, by which he renders wood, incombustible; the composition is made of granulated earth, and an alkali. To obtain this composition, the inventor says, you must dissolve some moist, gravelly earth, which has been previously well washed, and cleared from any heterogeneous matter, in a solution of caustic alkali. This mixture has the property of not becoming decomposed by fire or water. When spread upon wood, it forms a vitrious coat, and is proof against the two elements. The building committee of the royal theatre, have twice publicly tried the efficacy of the composition

on two small buildings, of six or eight feet in length, and of a proportionate height; the one was covered with the composition, and the other built in the usual manner. The fire was put equally in the two buildings; the one which was not covered with the composition, was consumed, whilst the other remained perfect, and entire. The cost of this process, is very insignificant, compared to its great utility, being about two francs three centimes per 100 square feet.

The royal theatre at Munich has undergone this process, having about 400,000 square feet; the expense of which was about 4 or 5000 francs.

The late Earl Stanhope made some very successful experiments upon this subject; he coated a building with sand and glue, which proved perfectly fire-proof.

ON CHRONOMETERS.

In the United States Gazette of the 8th inst. is a statement taken from Snowden's New York Advocate, of what is denominated "a curious discovery" upon the variation of chronometers. It appears that Mr. Harvey, of London, by repeated experiments, has ascertained that the density of the medium in which a chronometer is placed, has a sensible influence upon its rate; in other words, that a chronometer constructed in London, which is nearly on a level with the sea, would undergo an alteration of rate from a difference of atmospheric pressure alone, if transported to Madrid, Mexico, or any other place, much above the level of the place where it was constructed.

The cause will be found in the balance. All chronometers that are adjusted by screws, will vary in their time, according to the experiments of Mr. Harvey. These screws having large heads, one on each side of the balance, their line crossing the centre, and the loadings, the line of which crosses that of the screws at right angles, make *four projections*, from the rim; these, in consequence of its velocity, strike the atmosphere with great relative force. The effect produced is, that in a more elevated situation, or less dense medium, than that in which the chronometer was adjusted, its motion will be faster, and so the contrary, in a lower or heavier atmosphere.

A chronometer drops from 125 to 150 times in one minute, according to the calculation of the train; and a free, accurately made scapement, with a force of main-spring in proper accordance with the weight of the balance, will always give that balance, an entire revolution, at least, to every drop. The subscriber, at this time, has one made by Bissett, Royal Exchange, that throws its balance a revolution and a third, which gives it an action equal to two hundred complete circles, in one minute. When it is considered that the loadings of this balance, present a flat, and the screws, for adjustment, a round projecting surface to the atmosphere, and that all are upon its periphery, thrown back and forth, at the above rate, it will be readily perceived, that different densities will, in some degree, affect the action, and consequently the time of the chronometer. In

order to avoid such variation, it will be found necessary to abandon the loading, and the screws at present used for bringing chronometers to adjustment. Even the *arms* of an ordinary balance ought to be considered as an objection, where there is so much accuracy required, as in a navigating time-keeper. Suppose the balance to be turned out of a solid piece of metal, and instead of being crossed out into arms, turned down very thin, and left unbroken, between the rim, and centre: when perfectly true upon its pivots, its active motion will not create the least atmospheric resistance.

It will doubtless be said, that to give up the spiral spring, and the compensating balance in segments, would be sacrificing too much, to avoid the disadvantages of the surrounding medium. But let it be recollected, that the compensating balance, when it does act, is more apt to derange, than to regulate, the time. The subscriber, in one instance, knew a very expensive chronometer, with the compensating balance in segments, to lose from its usual rate, ten seconds in six hours, when exposed to a temperature of *five* degrees below the freezing point; when, by another time keeper, the effect of the frost upon the hair, or pendulum spring, was found to produce, at the same exposure, a *gain* of only two seconds; consequently, its *balance*, produced a variation of eight seconds. The writer has frequently observed, in adjusting a chronometer, and also duplex watches with chronometer balances, that when the cut in the screw-heads was brought nearly to a line with the motion, that by turning the screws outwards, until their cut was precisely parallel with the action, instead of losing, they would gain, upon their rates; evidently, because the atmosphere was struck by a smaller body.

Time-keepers might even be *regulated*, with some degree of accuracy, by *atmospheric resistance alone*. Suppose two thin pieces of metal, were attached to each side of the balance, in such a way as to be moved round, in order to present their *edges* to the motion; the *quickest* action would then be produced, and the *slowest* when the *sides* were carried against the opposing medium. The changes necessary to find the time, could be brought about, by turning the edges to the different degrees, from a horizontal to a vertical position. The atmosphere operating thus powerfully, the result of the ingenious Mr. Harvey's experiments upon its different densities, may reasonably be considered a settled fact. That it is altogether the *balance* of the chronometer which is affected, seems no less an undoubting conclusion.

BENJAMIN F. BAKER.

Philadelphia, March 28, 1826.

Proposed Polytechnic and Scientific College, in Philadelphia.

A public meeting of the citizens of Philadelphia, was called on the 4th of this month, at the instance of Peter A. Browne, Esq.; to take into consideration the propriety of establishing a college in this city, where English literature, the sciences, and the liberal arts, might be taught, without requiring for admission an acquaintance with the La-

tin and Greek languages; and where the price charged for tuition should be such, as to place within the power of the industrious mechanic, the opportunity of giving to his sons, a scientific education.

At this meeting, General Thomas Cadwalader presided; and Mark Richards, Esq. was appointed secretary. After some discussion on the merits of the question, it was, by an unanimous vote, determined, that it was expedient to establish such a college; and a committee, of eleven gentlemen, was appointed, "to digest, and report a plan" for the proposed institution. On the 25th instant, another meeting was called, when Mr. Browne, the chairman of the committee, presented a report, of which the following is an abstract.

The committee recommend, that in the College, to be established, instruction be given in every branch of knowledge requisite "for the agriculturist, the mechanic, or manufacturer; the architect, the civil-engineer, the merchant, and other man of business." The branches enumerated in the report, are: vulgar and decimal arithmetic, grammar, belles-lettres, geography, history, chronology, the mathematics, natural philosophy, including mechanics and astronomy; chemistry, mineralogy, political economy and the general principles of government and jurisprudence; the modern languages, particularly the German, French, and Spanish. They recommend that the Latin and Greek languages, should also be taught, to those who can afford the time and expense, and wish to learn them; and that in teaching the different branches of science, particular attention be paid to their application to the useful arts.

These are mentioned as the prominent branches of instruction, whilst others, not incompatible with the general plan, may hereafter be added; those which are merely ornamental, it is observed, should be excluded.

The committee deprecate the idea of superficial instruction in any department; and earnestly recommend, that whatever is taught in the College, be taught in the best manner; pains should be taken to impress upon the pupils the necessity of a thorough knowledge of the various branches which they undertake to acquire. Rolls of merit ought to be rigidly kept; and it should be a rule, inflexibly observed, that the honours of the institution shall never be conferred, except on those who really merit them, by their conduct, and attainments.

The remainder of the report, is dedicated to the expense of tuition, the number of pupils, the funds, and the manner in which the College shall be governed.

It is presumed, that the income, arising from tuition, will be equal to the ordinary disbursements. That a fund may be raised among our fellow citizens, by an annual subscription of two dollars; which, whilst continued, shall constitute the subscribers patrons of the institution; and by a payment of twenty dollars, or upwards, shall constitute them contributors for life.

It is recommended, that a memorial, asking the aid of the legislature, be laid before that body, at the opening of the next session.

For the government of the College, it is advised, that a board of 18 trustees should be appointed by the meeting, to continue in office

until the first Monday in March, 1827; on which day, and thenceforward annually, a new board shall be elected, by the annual, and life contributors.

The report was unanimously accepted, and the first board of trustees appointed, and empowered to name ward, and township committees, for the purpose of procuring subscriptions.

Considerable interest has been excited, by the proposition to establish an institution, upon the plan above indicated. A great innovation is proposed, in the principle upon which collegiate establishments, have hitherto been founded: it is, therefore, a point upon which a difference of opinion, must necessarily exist.*

The Editor does not deem it proper, to discuss the merits of this question, in a journal devoted principally, to operative mechanics, and the useful arts. He, however, will not dismiss it without remarking, that considerable misconception has been evinced, both by the opposers, and the advocates, of the proposed plan. By the former, it has been represented as unacceptable to those whom it is proposed to benefit, as it is said to be viewed by them, as *aristocratical*. The Editor, and many of his coadjutors, have conversed upon the subject freely and frequently, with persons who might be expected to urge such an objection, if any such existed, without having once encountered it. Some of the friends of the measure, have charged the gentlemen connected with the University, with being particularly hostile to the plan. Several individuals, so situated, have avowed their hostility; but speaking of the University, as a body, the charge is certainly unfounded, and like most other sweeping declarations, it is unfortunate that it should have been made, as it is calculated, by its injustice, to excite opposition. Several of the members of that institution, have expressed sentiments, the most friendly, to the plan; considering it as likely to benefit a valuable portion of the community, without producing injury to existing establishments. As a body, the University is to be viewed as altogether unconnected with the measure; as individuals, its members have an undoubted right to act upon their own convictions.

NOTICES.

In our last number we published, the Prospectus of "The Reports of Mr. STRICKLAND." To this work, which is of national importance, we again call the attention of our readers. On the cover of the present number, will be found a list of the copper-plate Engravings, which will accompany it. They are, in number, seventy-two; several of them, will be two, and some three feet, in length.

* It has been said, that a College where the Latin and Greek languages were not considered as fundamental branches, was a thing altogether unknown. This is a mistake: during the time that the Editor held the Professorships of Natural Philosophy, and of Chymistry, in the University of William & Mary, in Virginia, as well as for several years prior and subsequent to that period, the ancient languages were not taught, and the honours of the institution were given, for proficiency in English literature, and the sciences.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Dear Sir—In the first number of your Journal, I published a note, stating some reasons why the book, called "Fauna Americana," should not have received notice as an *original* work, stating that it is very little better than a mere *literal*, though *unacknowledged* translation from Desmarest, with the exception of "the description of about *fifty species*."

In a few days, I shall publish a letter, which, from its length, and the subject it treats of, I could not expect you to insert in the Journal. In that letter, it is my intention to state, in detail, the facts, relative to this plagiarism; and to show, that in an attempt to refute the charge made in your first number, the author of the "Fauna," has not fairly met the question before the public.

I am, with respect, your friend and servant,

JOHN D. GODMAN.

P. S. As soon as the above letter is published, a copy of the "Fauna," with references, together with the original work of Desmarest, will be placed in some public situation for inpection and comparison.

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[In the contest, to which the above alludes, the Editor wishes not to be considered as a partisan; although the discussion is not suited to his columns, they are open, to an equal extent, to either of the gentlemen concerned.]

TO SUBSCRIBERS AND CORRESPONDENTS.

Semi Doctus, appears to have a theory of his own, upon the subject of *Inertia*; his notices, however, are too brief, to enable others to understand it. If he will develope his ideas more fully, he shall receive that attention, which, from the specimen before us, we think he claims, by his talents.

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Our Subscribers will perceive, that the present number appears with a new type; other improvements are contemplated, and shall be carried into effect, with all convenient speed.

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A considerable portion of our 4th, or 5th number, will be occupied with a paper, on the subject of fuel, by Marcus Bull, of this city. It will detail a series of experiments, which have been carried on with singular industry, and skill, for upwards of two years. Gentlemen of science, well able to appreciate the merits of the undertaking, have viewed the apparatus employed, the enquiry in its progress, and the results obtained, with unqualified approbation. The memoir will be accompanied by a plate of the apparatus.

An article of equal length, will not, probably, again appear in a single number of the Journal; the Editor, however, is of opinion, that the communication alluded to, will plead its own cause, and require no apology from him.